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ABSTRACT

Third in a series, this seminar was organized to study the various uses of computer science in education and to analyze the main trends in that field, as well as to discuss problems encountered by the national education systems of 10 countries in the implementation of computer education. This report from that seminar is divided into five major sections. The introduction describes the purpose and organization of the Asian Programme of Educational Innovation for Development (APEID) together with its participation in advanced technology activities. Chapter 2 contains survey information on current computer education and future trends for the 10 participating countries: Australia, China, India, Japan, the Republic of Korea, Malaysia, the Philippines, Singapore, Sri Lanka, and Thailand. Chapter 3 discusses such issues as trends in computer use, training for business and industry, teacher training and retraining, curriculum materials for teacher training, quality and availability of software, determining priorities in purchasing microcomputers, equality of access, ergonomic considerations, copyright, developing policy, and identification of learners. Chapter 4 presents guidelines for curriculum evaluation and development in computer education, and Chapter 5 contains 13 recommendations for curriculum organization, teacher training, regional cooperation, and UNESCO/APEID responsibilities. Appendices include a copy of the opening address, a seminar schedule and agenda, lists of the participants and members of the organizing committee, and a curriculum guide from the Japanese Ministry of Education, Science, and Culture for microcomputer training for educators. (JB)

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COMPLIMENTARY CO

Chapter One

INTRODUCTION

APEID and the Japan Council of Educational Technology Centres

The Asian Centre for Educational Innovation for Development (ACEID), which co-ordinates the activities under APEID and assists the Associated Centres in carrying them out, was established in 1973. Since the first cycle (1974 - 1977) Japan has participated fully in APEID activities.

There are five Associated Centres of APEID in Japan, and each of them is actively involved in the implementation of this active endeavour. They are (a) the Japan Council of Educational Technology Centres (educational technology); (b) Obihiro University of Agriculture and Veterinary Medicine (vocational and technical education); (c) the Agricultural and Forestry Research Centre of the University of Tsukuba (vocational and technical education); (d) the National Institute for Educational Research (NIER), (a multipurpose Associated Centre); and (e) the National Institute of Special Education (NISE); (special education). These centres are making efforts to promote international co-operation through participation in Unesco mobile teams, the organization of seminars and workshops, and the dissemination of information on innovative practices in Japan to other participanting Member States, etc.

The Japan Council of Educational Technology Centres (JCETC) has been formed to carry out co-operative activities in the area of educational technology. The council consists of four major institutions: (a) the Council of National University Centres for Educational Technology (CNUCET); (b) National Institute for Educational Research; (c) National Institute of Special Education; and (d) Centre for Research and Development of Educational Technology, attached to the Tokyo Institute of Technology.

In the Council of National University Centres for Educational Technology, 34 centres attached to faculties of education in national universities join in and share research experiences and development of educational technology through two annual study meetings and a journal; four issues in Japanese and one in English, i.e. ' Educational Technology Research '. Recent themes of research and development among members of CNUCET are to:(a) improve teaching practice programmes in pre-service teacher education; (b) develop educational information processing systems; (c) apply information technology to improve teaching and learning practices; and (d) initiate a new programme of in-service teacher education.

The Centre for Educational Technology of Tokyo Gakugei University, host centre of the seminars, is one of the most active institutions in the area of educational technology. The researches being done at

the centre are closely related to those which Japanese educational circles are now facing up to; improvement of pre-service teacher training, application of micro-electronic technology in education, and curriculum development for information processing education. Other centres of CNUCET, the Centre for Educational Research and Training of Kyoto University of Education, Curriculum and Development Centre of Gifu University, and Centre for Educational Technology of Aichi University of Education, are also deeply involved in activities of APEID in Japan.

APEID participation in advanced technology activities

Through its network of Associated Centres, APEID has promoted a number of activities in the field of advanced technology involving in-country experiences; information exchanges; workshops; seminars; training courses; attachments and curriculum development;as well as reports and recommendations.

A 'Study Group Meeting on the Applicability of Advanced Technologies to Educational Development' was held in Penang, Malaysia from 20 to 24 September 1982, organized by ACEID, Unesco ROEAP in collaboration with University Sains Malaysia and RECSAM. The objectives of the seminar were to synthesize national initiatives in, and future plans for, the use of advanced technologies for education, with a view to identifying growth points,gaps and problems in their design, production, utilization and evaluation in participating countries.

In Chapter Five of the final report of the study group meeting, titled 'Future Perspectives', it was concluded that:

- In Japan teachers must be trained to develop materials, and researchers must develop courseware and methods of evaluation before microcomputers could be introduced into schools. Institutions must also be set up to develop, maintain and deliver individualized materials. The other participants also made observations about the possible future use of microcomputers in education:
- In New Zealand, all schools will soon have microcomputers. They will gradually replace typewriters and it is predicted that in a school of 1,000 students, three sets of microcomputers will be in use, with one set in geography, one in typing, and one in the computing department.
- India is using computers for data processing. Its use is likely to increase in universities and other institutions.
- In Australia, computers will continue to penetrate into schools at all levels. A dramatic increase in computing will occur. The number of applications will increase to include CAI to assist in helping handicapped students. The high cost of labour will lead to rapid office automation.
- Microcomputers will be increasingly used in Malaysia for administration, computer studies, CMI and CAI

during the period 1983 - 1994, and the number of computer clubs in schools will increase.

In the context of APEID, JCETC held the first Asian Seminar on Application of Educational Technology in 1973, followed further by eight seminars concerning the application of educational technology also convened in Japan. Japan has sent abroad more than 20 experts in educational technology as resource persons for national training courses or workshops organized in other Asian countries.

A variety of themes have received priority for the activities and discussions of past seminars:

i) production and utilization of programmed materials;
ii) utilization of mass media, especially effective use of radio and television as means of education;
iii) development and utilization of low-cost teaching and learning materials;
iv) improvement of teacher training through the techniques of educational technology, especially utilization of video cassette recorder for micro-teaching;
v) study on information processing for education, including microcomputer.

A more recent seminar on educational technology was held in Tokyo from 17 to 26 October 1983, conducted by the Japan Council of Educational Technology Centres with its own funding. The objectives were:

i) To exchange information/experiences, and identify common problems in educational programmes in relation to the basic and applicable research on advanced technology, especially on microcomputer and video technologies; and
ii) To acquire information and have experience in the strategies for effective implementation, design, selection, use and evaluation of advanced technology.

Eleven countries submitted country reports. Some common issues were found to be: (a) the need for well trained personnel with the right skills and attitudes; (b) the identification of needs in advanced technology; and (c) the fear that hasty implementation of advanced technology in education could widen the disparity between groups or regions - particularly between rural and urban areas.

Recommendations included the dissemination of expertise through inter-country study visits, exchange of personnel through attachments/internships, seminars and workshops; the establishment of a clearing house to facilitate the exchange of information relating to software development, research results, outcomes of all related seminars or workshops, and teacher training plans and curricula of the participating countries; the possibilities of mobilizing community resources; and the development of strategies to improve classroom instruction through the use of advanced technology.

Other activities

Under the Japanese funds-in-trust for Regional Mobile Teams on Educational Technology two activities have taken place:

i) Mobile Team in Educational Technology, 11th Cycle - Korea 1983. A study visit to Japan and Thailand was made by three staff members of KEDI(5-12 March 1983)to acquaint them with current practices and enable them to see the application of computer assisted instruction (CAI). This was followed by an in-country training workshop on educational technology on the practical application of new educational technology methods, preparation of educational TV programmes and implementation of computer assisted instruction in education at KEDI(6-23 April 1983).

ii) Mobile Team in Educational Technology, 12th Cycle - China 1984. A study visit to Japan and Australia was made by three Chinese senior faculty members (1-13 March 1984). This was later followed by an in-country training workshop on the practical application of new educational technology methods, preparation of educational video-tapes and implementation of CAI in education (Beijing 1-15 June 1984) attended by two consultants and 50 participants. The consultants then undertook a mission to Thailand for discussions and consultations.

A resource person was provided to the Seminar on Microcomputers organized by the Science Education Centre of the Philippines (Manila 1-19 August 1983). This was a middle level training course in the use of computers for the benefit of selected staff of Associated Centres.

The University Sains Malaysia was provided the services of a resource person during August 1983, to develop a programme of training which was launched during 1984 with focus on application of computers to mathematics and physics teaching at senior high school level, and linking of computer use to other media. In Kuala Lumpur, the national education authorities as well as staff of the Associated Centres in Malaysia also held consultations with the resource person to review the future plans for the use of computers.

The resource person returned in August 1984 to advise on a computer training programme and to participate in the National Training Workshop on computer education.

A programmer of the computer unit of BANBEIS, Dhaka, Bangladesh was provided an attachment to the Centre for Educational Research and Training (CERT) attached to Kyoto University of Education from 17 October to 12 November 1983 to study the application of computers in data base management and to research.

A consultant conducted a mission to India from 25 July to 1 August 1984 at the invitation of the

Indian Government to advise the Ministry of Education on the introduction of computers in education.

Many references were made to computers in education in the report of the 9th Regional Consultation Meeting on APEID, March 1984. They are listed as follows:

(page 31) Part Two: Review of Progress 1982-1983

85. The emphasis on the activities during the third cycle is on the development of systems and structures. Apart from the technologies which were covered earlier, textbooks and reading materials, distance learning and computer use have been the main new lines of development.

(page 59) Part Three: Major Education Trends and Developments Computer Education

90. Malaysia is also embarking on the area of computer education in schools. This year 75 schools, on their own efforts, have already formed computer clubs, having from one to eight microcomputers each. The plan is to co-ordinate the activities of these clubs and introduce this subject in a formal way leading to the GCE 'O' and 'A' levels in 1986. A pilot project on computer education is hoped to be launched next year.

173. Computer-based progress control: Action will be taken to computerize the progress control work of the Ministry (Sri Lanka).

227. IBE also maintains a computer-based documentation centre which is at the service of the Member States. In the future, IBE hopes to exchange information with Member States through exchange of microcomputer floppy discs and perhaps by direct linkage of computer-based documentation services.

(page 113) Part Four: Guidelines for the Work Plan 1984-1986 Computers in Education

108. Interest in computers in education was expressed during the 8th Regional Consultation Meeting, particularly in relation to the teaching of computer studies as part of science education programmes at secondary level. The development of suitable co-operative activities on a priority basis in computer education, together with computer use in retrieval information systems were seen as essential first steps.

110. As of 1984, Unesco will convene an Intergovernmental Committee for Informatics to organize and run an international programme of co-operation to apply computers to development, to which the Member States will be associated.

111. The APEID programme for 1984 has already agreed to study the various uses of computer science in education, and will take stock of trends and prospects in the application of data processing and use of computers in

education; to explore the establishment of a machinery for the continuous updating of information on the educational applications of data processing and computers; and to collect and publish data relating to significant examples of such applications.

112. The meeting suggested that all NDGs should ensure that 'the state of the art' studies are transmitted to APEID so that an information base could be available with which to develop future programmes.

113. As a follow-up of the proposed 1984 activity, the Meeting suggested that during 1985 APEID should convene a study group of experts to further develop the concept of 'computer literacy/computer science/computer education', and at which levels and in which forms they could be applied. This could form an integral part of general or technical and vocational education programmes in the Member States and would have implications for teacher training programmes.

114. The meeting was reluctant to endorse any premature programme development until the baseline data arising from the survey was available. The Meeting cautioned against any precipitate action in the present fluid situation with the development of educational software for school computer programmes.

115. The computers in education have a variety of uses such as computer education or literacy; management and administration of education systems; as a tool to facilitate the teaching and learning process; information retrieval; data processing; and educational research. However, considering the resource constraints and efforts already being made in the Member States, APEID should concentrate on innovative activities for promotion of computer literacy or computer studies as a part of general and technical education. In addition it would facilitate development of more programmes if ACEID starts maintaining an index of computer use.

Recent Innovative Experiences

1. Ministry of Education - Japan, Standard Curriculum Guide for the Training of the Educational Usage of Microcomputers (Intermediate Report)

This curriculum guide mainly seeks to help in the training of the general operation and method of usage of the microcomputer for various educational activities. It has no direct concern for the training of specialized fields of computer study in the various formal subjects.

It is intended for use in educational administrative institutes, formal educational institutes (AV

centres, educational centres, schools etc.), non-formal educational institutes, AV educational and other educational research groups at different levels all over the country.

Training is divided into three levels - elementary, intermediate and advanced. The curriculum guide also sets standards for the training objectives, training hours and essential training content for the three respective levels. The programme is for teachers, office staff and supervisors of non-formal educational institutes, non-formal education supervisors, private voluntary instructors etc.

The objectives of training at each level are regarding (a) knowledge; and (b) skill. Training time, based on six hours per day, is 2.5 days for elementary, 5 days for intermediate, and 8 days for advanced.

The training area and training methods are as follows:

a) General statement
   In the training for the three respective levels training will mainly be given through lectures that a general outline of study would be given for the introduction of content, the microcomputer itself and its educational usage at different levels.

b) Operation
   To do practical work at different levels to become familiar with the operation of the keyboard and peripheral units of hardware.

c) Programming
   To practice the designing of systems and writing of programmes at different levels; to emphasize the analysis of subject as a preface to programming.

d) Application
   To learn necessary knowledge and skill about the application of the microcomputer for educational usage at different levels. Lectures, practical work and discussion will be used.

2. Australian plan for computer education - report

The report of the National Advisory Committee on computers in Schools, 'Teaching, Learning and Computers - 1984 Information Kit', Commonwealth Schools Commissions, Australian Capital Territory, was published in 1983.

Computers have been used in Australian schools for more than a decade. There has been great variation in the rate of development between schools and education systems.

In an endeavour to develop a satisfactory programme of computer education in Australian schools the Commonwealth Schools Commission, in March 1983, appointed a 23-member National Advisory Committee on Computers in Schools and requested it to make an initial report by 30 September 1983. The Committee

established six technical working parties in the areas of: (a) Professional Development; (b) Curriculum Development; (c) Software/Courseware; (d) Hardware; (e) Evaluation; and (f) Support Series.

The report summarizes the present situation in the States and Territories of Australia and presents the proposals and recommendations of each of the Technical Working Parties. Printed in 1984 it succeeds the initial report of 1983 and includes briefing notes; the Commission's advice to the Government, based on the Report; the Government's decisions; and programme guidelines for computer education.

Of the 52 NACCS recommendations, all but two were endorsed by the Federal Government, which had initially provided the funding for the activity.

3. New Zealand Special Unit for Computer Software Preparation

The Computer Courseware Development Unit was established within the Department of Education in April 1984. 'Courseware' refers to computer programmes for educational use, together with supporting written material to facilitate its classroom use. The Unit is to set standards for courseware; to evaluate existing courseware; to develop New Zealand-based courseware for schools; to co-ordinate courseware writing by teachers; to advise teachers on the use of computers; and to develop computer-based curricula. The Unit is staffed by two permanent officers and has provision to second the equivalent of 1.5 teachers. Initially the Unit's priority is to service secondary schools.

4. Information technology development in Singapore

To maintain its high rate of economic growth, Singapore must move to higher technology based industries and services. The population must be adequately trained in the use of computers. To this end the Ministerial Committee on National Computerization was appointed by the Government to formulate a strategic plan to establish Singapore as a centre for computer services.

The National Computer Board, established in 1981, implements the plan through the Civil Service; co-ordinates computer education and training; and develops and promotes the computer services industry. A pool of professinals has been built up; three computer training institutions established; and a board-level Computer Education and Standards Committee appointed to advise on the policies and issues pertaining to computer education and standards. The Board sets and maintains professional standards through examination and national certification.

The Purpose of the Seminar

a) The Third Asian Seminar on Educational Technology (Tokyo Seminar), Third Programming Cycle of APEID, was held at the Tokyo Gakugei University, Japan, from 25 September to 2 October 1984. The Seminar was organized by the Japan Council of Educational Technology Centres, financed by Unesco and was based on the guidelines for the Third Cycle Activities of APEID, the Conclusions of the First Tokyo Seminar (October 1982) and those of the Second Tokyo Seminar (October 1983) in line with the same cycle activities of APEID, and at the request of ACEID.

b) The Seminar also served as a consultation meeting of specialists on the application of data processing in education with reference to Resolution No. 4.1 adopted by the General Conference of Unesco at its 22nd session. There were 33 participants, two each from Australia, China, India, Republic of Korea, Malaysia, the Philippines, Singapore, Sri Lanka and Thailand and 15 from Japan. There were nine observers and a representative of Unesco, ROEAP.

c) The request to the Japan Council of Educational Technology Centres by ACEID, Unesco, ROEAP, to host this seminar was in general, guided by the following background:

> In preparation for an international symposium on the main fields in which computer sciences might be applied to education and on the research required for that purpose, to be held in Spring 1985, Unesco's programme foresees the launching of regional or sub-regional surveys on the development of computer sciences and technology (otherwise informatics) in order to identify the possibilities for applying computers and microcomputers in education and in the educational process, bearing in mind the special features in applying informatics in education in different environments. These surveys will be discussed during regional consultation meetings with specialists, administrators, researchers and educators to be held in Africa, Asia and the Pacific, Latin America and the Caribbean, and the Arab States before the 1985 Symposium.

d) At the Ninth Regional Consultation Meeting on APEID, held from 20 to 26 March 1984, delegates' consent was given to the following statements: the APEID programme for 1984 has already agreed to study the various uses of computer science in education and will take stock of trends and prospects in application of data processing and use of computers in education; to explore the establishment of a machinery for the continuous updating of information on the educational applications of data processing and computers; and to collect and publish data relating to significant examples of such applications.

The purpose of the Seminar was to:

i) Exchange information and experience, and consider significant examples in the development of computer education and computer (including microcomputer) use in education in different domains;

ii) Analyse the main trends in that field, as well as problems encountered in this respect by the national education system and to review instances of effective strategies for coping with the problems;

iii) Explore alternative mechanisms for continual updating of information on the application of data processing and use of computers in education; and

iv) Produce a survey report on the themes, requested from ACEID in the context of 'Background (c) (d)' stated above, especially within Asian and Pacific countries to submit to the International Symposium in Spring 1985.

The Seminar was addressed by Mr Nobuo Nishizaki, Deputy Director-General, Minister's Secretariat, an introductory address was given by Professor Haruo Nishinosono, Chairman, Japan Council of Educational Technology Centres and a welcome address to the participants was given by Mr Takeshi Abe, President of Tokyo Gakugei University.

The following participants were elected as officials of the seminar:

Chairperson: Ms Asiah bte Abu Samah (Malaysia)
Vice-chairpersons: Mr Haruo Nishinosono (Japan)
Mr Yeong Kum Tien (Singapore)
Rapporteurs: Mr Jonathan Anderson (Australia)
Ms Emma Teodoro (Philippines)

Two working groups were formed to explore the use of computers in education from the points of view of (A) policy and (B) teaching and curriculum.

The groups comprised:

GROUP A Policy Group
Mr Haruo Nishinosono (Japan)---Chairperson
Mr Jonathan Anderson (Australia)--- Rapporteur
Mr Raghuvendra Singh Sirohi (India)
Mr Haji Zainal Abidin bin Haji Ahmad (Malaysia)
Mr Nilo Rosas (Philippines)
Mr Chang Suk-Min (Republic of Korea)
Mr W. Sterling Perera (Sri Lanka)
Mr Kwek Yock Hwa (Singapore)
Mr Wang Changpei (China)
Mr Narong Boonme (Thailand)
Mr Takeshi Shimoyama (Japan)
Mr Yoichi Nishimoto (Japan)
Mr Bruce R. Cahill (Unesco)

GROUP B Curriculum Group
Mr Yeong Kum Tien (Singapore)---Chairperson
Ms Emma Teodoro (Philippines)---Rapporteur
Ms Toni Downes (Australia)

Mr Hosakere N. Mahabala (India)
Ms Asiah bte Abu Samah (Malaysia)
Mr Danai Youngkhong (Thailand)
Mr Abhaya S. Induruwa (Sri Lanka)
Ms Ma Shu-Yang (China)
Mr Park Duk-Man (Republic of Korea)
Mr Fumihiko Shinohara (Japan)
Mr Setsuo Yokoyama (Japan)
Mr Hidetsugu Horiguchi (Japan)
Mr Shobi Inoue (Japan)
Mr Shigeru Narita (Japan)
Mr Ken Kanatani (Japan)
Mr Bruce R. Cahill (Unesco)

A General Information Paper was presented by one participant from each country comprising background information on the development of computers, including infrastructures, policies, plans, programmes, research and training; trends and issues on computer education; and the current activities in his/her institution in the aspect of educational technology. These papers were presented and discussed during the first two plenary sessions.

The qualifications asked of this participant were that he/she should be '... critically involved at a high level, maker or decision-maker in respect of computer education and computer applications in the education system'.

Countries also answered a questionnaire titled 'Microcomputer use in education and its related fields' comprising the following main headings:

I. Computer assisted instruction
   A. Present situation
   B. Development plan
II. Training in computer science
   A. Present situation
   B. Development plan
   C. Comments
III. Information systems and their societal implications
IV. Computer managed instruction
V. New audio-visual facilities
   A. Present situation
   B. Development plan
   C. Comments
VI. Educational uses of communication
   A. Present situation
   B. Development plan
   C. Comments
VII. Software
VIII. Teacher training
   A. Present situation
   B. Development plan
IX. Specific areas of education
X. Introduction of new information technologies in education: Questions and Perspective

The questionnaires collected during the briefing session were analyzed and the results discussed during

the working group sessions.

This participant was expected to be .... 'qualified in computer applications, with experience of curriculum development, or training or evaluation in computer education, or application of computers in the education system'.

Expected Outcomes

1. As a result of the presentation of the country experiences and the analysis of the questionnaire, the report of the seminar should give advice and make recommendations based on the Asia-Pacific perspective.
2. The report should identify the possibilities for applying computers and microcomputers in education and in the educational process, bearing in mind the special features in applying informatics in education in different environments.
3. A substantial part of the report should be devoted to the following aspects:

   I. General

   Before looking at the development of informatics and micro-informatics in education in a given country, some idea should be given of the use of computers and microcomputers in society, along with an identification of human resources and technological infrastructures available. Data collected in this respect should include an inventory of information on:

   a) Main trends in the use of computers and micro-computers for different types of activity (management research), especially in the public sector - types of use, estimation of growth rate over the last few years;
   b) Training - levels of training (engineers, computer specialists, programmers), number and type of institutions (universities, institutes of higher education, training given by informatics companies), training abroad;
   c) Infrastructures: production or assembly of microcomputers imports main sources of software existence of commercial networks;
   d) Existence of computer centres within universities or administrations;
   e) Pilot or experimental projects (on-going or foreseen);
   f) The extent to which the use of computers and microcomputers has been the subject of national or regional meetings, the main points dealt with and the

conclusions reached; and

g) The suggested mechanisms by which this inventory may be updated.

II. National policy on informatics

a) Does a national policy exist for the development of informatics, for the training of specialists and for the use of computers in the educational process (priorities and other characteristics)?

b) Has the need for specialists in this field been evaluated at the national level? Is the development of training facilities foreseen ?

c) In the absence of a national policy for informatics, can partial local tactics be identified, specially those of private companies, for the promotion of informatics?

d) How can NDGs ensure that 'the state of the art' studies are transmitted to APEID for the compilation of an information base?

III. Informatics applied to teaching

This section is not concerned with problems of training specialists and technicians (cf. I.b. and II.b.) but with applications to education, i.e., in teaching or for the administration of educational institutions.

a) Priority fields for the introduction of informatics in the educational process:
- as a tool for teaching (CAI)
- as content: computer literacy - computer sciences -as an autonomous subject or associated with other disciplines (mathematics, sciences);
-used for management and documentation in education.

b) Origin and extent of these developments - Are these applications made within public schools or private schools, are they originated at the request of national authorities or parents with external financial assistance? Are they at an experimental or pilot stage or already developed? What percentage of institutions are involved at the higher, secondary and primary levels? Type of equipment (computers, mini-computers, microcomputers). Informatics clubs. Sources of finance.

c) Training teachers to use informatics - are training facilities organized - by whom - duration - what is the attitude of teacher unions and associations?

d) What types of courseware are used - proportion of imported / nationally

produced courses. What computers are used?

e) Overall results and difficulties encountered.

IV. Suggestions for the development of informatics applied to education

Summary

Plenary sessions were held to enable the presentation of country papers, the progress reports of the working groups deliberations, the compilation of the recommendations of the seminar and the adoption of the final report. Two working groups were constituted to study and report on (A) policy; and (B) teaching/learning and the curriculum in the educational use of computers. Participants summarized their country reports and these appear in Chapter Two. Two half-day visits were made to (a) the computer display, held at the Tokyo International Trade Centre; and (b) the attached schools of Tokyo Gakugei University, where the use of computers in the computer club situation were observed. Some time was also allowed for participants to display some of their computer programmes.

Chapter Two

SURVEY OF DEVELOPMENT IN PARTICIPATING COUNTRIES

Australia

Background

Government policy

Australia does not have a national education system. Under the constitution, schools are the responsibility of the different states. With six states and two territories, there are eight separate authorities which determine the direction of computer education in government schools. Non-government schools are independent and may adopt their own computer education policies. The Commonwealth Government has for the first time (1984) embarked on a national computer education programme. The aims of the programme are to:

- make it possible for students to learn about computer technology and its social impact; and

- integrate computers in appropriate ways across the whole curriculum.

Development, trends and issues

Computers have been used in Australian schools for teaching and administration for more than a decade, and in universities mainly as research tools for much longer. In 1983 and 1984, the introduction of microcomputers into schools accelerated sharply. The Australian Council for Educational Research published a review entitled Computing in Schools (Anderson, 1984) but the most influential report was that of the Schools Commission (1983) in which it set forth its recommendations for a national Computer Education Programme for the period 1984 to 1986. This initiative acted as a catalyst for change in those parts of the country where previously little co-ordination was apparent. The most important issue identified in the report was the need for professional development of teachers. Other important issues are "equity" issues relating to computer education for girls and equality of access to computers regardless of geographic location or socioeconomic area.

Constraints

The major constraints affecting the implementation of a computer education programme in schools are a lack of suitably highly qualified teachers at all levels and the shortage of adequate

software. The vast majority of commercially available CAI material runs counter to the philosophy of teaching and learning held by many teachers and the indiscriminate use of these materials in the classroom is considered likely to retard teaching practice considerably. Another constraint relates to the distribution of computer services to remote communities in the outback.

Professional societies

Computer - user groups in all states of Australia have helped promote the cause of computer education, organizing seminars and conferences for teachers and teacher educators. Prior to 1983, certain of these user groups filled the vacuum resulting from activity on the part of some Education Departments to take a leadership role in computer education. The Australian Computer Society also features computer education as part of its annual conferences. Most professional subject associations are beginning to devote increased attention to educational technology, especially to microcomputers.

Status of computer use

In all parts of society, computer technology holds a high profile. The president of the Australian Computer Society expressed the sentiments of many when he stated that " We are, without doubt, on the threshold of the most revolutionary set of technological innovations that humankind has yet had to deal with. As a nation it behoves us to carefully and thoughtfully consider the future we want for ourselves and for our children." (Goldsworthy, 1983)

Manpower needs and training

Although virtually all universities offer degree programmes in computer science, the general experience is that course quotas are over-subscribed. Unfortunately, these quotas are imposed because of a shortage of staff and computing facilities, rather than as a result of the needs of industry. Currently, there is some difficulty in filling senior positions in the computing field. Nowhere is this difficulty more acute than in computer science departments within universities.

Institutions involved

Institutions involved in computer education include all universities, most colleges of advanced education, institutes of technology and technical colleges. Within each of the Departments of Education in the eight states and territories, there is a computer centre or education unit catering specifically for the needs of teachers. The oldest of these centres has been operating since 1962.

Present trends and issues

Policy formulation

At present the National Computer Programme in Australia is guided and monitored by the National Advisory Commitee for Computers in Schools. Current work of this group is the investigation of the need for a National Primary Schools Programme, the evaluation of the National programme, the development of software, educational user technical specifications for educational microcomputers. In each state, government and non-government systems have co-ordination committees to guide and monitor projects at a state level.

Formal education

There are a number of observable trends in schools. At the primary level, there is a movement from drill and practice programmes towards word processors, data bases, LOGO, simulations and other open ended software. At the secondary school level, there is a decreasing reliance on BASIC programming. Packages representing " real world applications " are becoming more central to Computer Literacy Courses.

Non formal education

Through the sponsorship of the Federal Department of Science and Technology and the Australian computer Society an " Information Technology Week" is held in which a multitude of activities are organized to heighten the general community's awareness. This week has been so successful in past years that in 1984 an "Information Technology Month" is being held.

Special education

Possibly the most significant research in computer education has been conducted in the field of special education at the Australian National University. Led by Lally and Macleod, the Information Sciences Laboratory has been researching computer-aided skill development for nearly a decade. Early work of the research unit focused on teaching handwriting skills to mildly intellectually handicapped students while more recent work has investigated the use of computers for teaching reading. Initially a PDP - 11/20 minicomputer was used with a graphic display screen manufactured by university staff before these latter devices became available commercially. Current work of the Unit is to extend the earlier findings of laboratory and clinic to the classroom, in a systematic exploration of microcomputers for developing handwriting, reading, and number skills.

Innovations

Australian teachers are exploring the use of microcomputers in many imaginative and innovative ways. Worthy of mention is the use of wordprocessors in the primary school as part of a process approach to writing; the use of database programme packages such as The First Fleet, Birds of Antarctica and Somerleyton Census produced by the Elizabeth Computer Centre for primary and secondary use; the early development of LOGO and the manufacture of the Tasman Turtle, which is now exported to many countries including Britain and the United States. At the secondary level specifically, the development of a software package called Karel the Robot by Angle Park Computing Centre provides a gentle introduction to programming in Pascal in some schools.

Brief statistical statement

- Over 95 per cent of all high schools own at least one microcomputer.

- There are over 10,000 microcomputers in schools.

- Over 15 per cent of all primary schools own at least one microcomputer. In two states more than 85 per cent of primary schools have microcomputers.

- Major source of funding for hardware is the school and its community.

- Somewhere between 5-30 per cent of teachers have received in-service training.

Future development

Formal education

There is still urgent need for development of software and curriculum materials and provision of professional development activities to facilitate the integration of computers across the curriculum.

Informal education

"Information Technology" activities will continue. The number of magazines on computers and related technology is increasing dramatically.

Teacher training

Australia needs to look for creative responses to problems associated with training large numbers of classroom teachers.

eg. Broadcasting / Video Tapes;
Self instructional / Multimedia modules;
Within school in-service by Resource Teachers.

Innovations

The most innovate work in computer education is taking place at the schools level and much of it is in software development. In keeping with the aim of integrating computers across the curriculum, the developmental work of the Schools Computing Centre in Western Australia is particularly noteworthy. A primary science software programme package, Dirigibles, and a mathematics Number Base Conversion programme are outstanding examples of the microcomputer used for simulation and demonstration respectively, illustrating how computer software can complement classroom teaching and learning. An innovation of a different kind is the exploratory work of TASNET, a statewide educational computer network, not only to make overseas' databases available to students in schools, but also to make available information services normally accessed by the news media. Through these services students will make their own selections of news and then compare these with those made by newspaper editors.

Training

All Universities and Institutes of Technology offer undergraduate and post graduate degrees majoring in Computer Science. Many of the Technical Colleges offer courses in data processing and other computer related fields. Industry also plays a role in training computer personnel. At present there exists a shortfall between the number of trainees and the number of jobs available.

An increasing number of short optional (in some cases compulsory) courses are being offered in teacher training institutions. For the present the major thrust is through in-service activities. In-service activities fall into two categories:

1. short (20 hours) and long (6 weeks) courses provided by Departments of Education and professional teachers associations;
2. Graduate Diplomas in Computer Education at a large number of Colleges of Advanced Education. It is estimated that in the smaller states in Australia more than one third of the total teaching population has received in-service training.

Background

Developments, trends and issues

The Chinese Government pursues a policy of developing microcomputers and giving priority to the application of microcomputers. It aims at popularizing the application of computers by 1990 in big enterprises and colleges, in selected key enterprises of medium size, research institutions and institutions of economy management, to equip (some) middle and primary schools in the city and some primary schools in local villages with a certain number of computers. The development of computer science is restrained because of the low ratio of working efficiency to the cost of computers made in China. Besides, the service system has failed to keep up with the rapid progress of computer applications.

Status of computer use

Computers have found wide application in rocket launching, population census, oil exploration, medical services and banking.

Present trends and issues

Policy formulation

Positive measures are being adopted in expanding the scale of experiment in computer education in a planned way. There are difficulties in teaching the students knowledge of BASIC and the role computers play in human society.

Curriculum development specifies computer courses in middle school, which are mostly optional in Senior I and II, with an allowance of 45 - 100 class hours per term. In junior schools, the students receive computer education as part of their extra curricular activities.

The Ministry of Education has decided to start computer education in primary schools in 1984.

Training

On the one hand, universities and colleges will produce highly qualified teachers and experts and on the other, offer in-service training to teachers of both middle and primary schools.

Innovations

CAI, courseware has been produced for in the teaching of Math, Physics, Chemistry, Geography, etc.

Future development

Computer education has become an inseparable part of education as a whole and plays an important role in the development of the students' intelligence. China is now engaged in the study of the following issues through the experience drawn from pilot schools:

What is the relationship between computer education and other subjects?

How will the computer play its role in teaching?

Background

Government policy

Government policy in the field of education recognizes the need to adapt emerging areas of technology to inform, to provide skills and to educate the people to enable them to realize their full potential for national development. Educational technology is viewed as an important means for improving the efficiency and extending the reach of educational programmes. In the context of developments in the field of micro electronics, Government policy recognizes the need to expose children to the nature and applications of computers in different walks of life and computer literacy forms the core of a pilot project recently launched in 250 schools in the country.

Developments, trends and issues

The computer industry in India has now developed capabilities for the indigenous manufacture of medium scale systems which are presently being marketed by the Electronics Corporation of India Limited. A govermment undertaking, microprocessors / mini computers are presently marketed by 50 companies and about 100 others have been licensed for production. The major emphasis today in the development of the mini computer / microprocessor industry is on the setting up of system engineering companies for the production of a standardized range of CPUs and peripherals built on an OEM basis, so that basic building blocks for micro processor based systems can be available at reasonable prices. Professional services for developing / design of custom applications have become well-established, and software exports during 1983 amounted to Rs 130 million.

Use of computers in the field of education has so far been confined to higher-level institutions. Computer courses have been integrated into engineering education in the country and courses in numerical analysis, and FORTRAN programming are taken by all engineering students. There are some instances of computer aided instruction, but at present computers are largely used as a tool or to teach computer science. In the field of school education, a pilot project has been launched in the current year (1984) to introduce computer literacy and awareness in secondary / higher secondary schools (CLASS). Under the project, computers will be introduced as a teaching-learning tool, to build up awareness and as a supportive of the school curriculum. The participating schools have been drawn from a national network of schools run by the Union Government, State Government and

some private schools. Forty-two resource centres have been selected from amongst universities and engineering institutions in the country to provide teacher-training, development of curriculum and teaching strategies, consultation and maintenance support to the participating schools. Keeping in view the wide dispersal of schools and resultant constraints in providing maintenance facilities at the user's location, a system of maintenance by replacement (of defective systems with working ones) has been devised with the support of the Computer Maintenance Corporation, a Government undertaking. Seven hundred and fifty teachers from disciplines relating to commerce education, sciences and mathematics have been trained through intensive 3-week courses conducted in July / August 1984. A uniform curriculum has been developed for students (and for teachers), even though school syllabi differ widely from state to state. Curriculum is based mainly on problem solving through the use of generic packages involving programming-like activity but does not include programming instruction.

Constraints

Concerns in the universal adoption of the programme arise from the diversity in the educational pattern, as well as problems associated with magnitude in a country with a large population spread over a large geographical area. Regional disparities in development levels, low level of urbanization and lack of infrastructural facilities in rural areas and the multi-lingual character of our society increase problem dimensions. Lack of resources also gives rise to issues regarding equity and educational priorities when mass illiteracy continues to be a major problem.

Status of computer use

Computers are widely used for data processing applications in business as well as government, as a research tool in universities and engineering institutions. Steps have been taken to establish public data networks to facilitate information exchange and also to provide remote access to specialized hardware and software. Systems are being developed for public utilities like railways, airlines and banks etc. Engineering design has been computerized to some degree and computer aided management is also receiving attention. A professional organization - Computer Society of India - has been in existence for many years and its chapters organize training / certification programmes for members as well as the public.

Manpower needs and training

Graduate programmes (B. Tech) in computer science and engineering are available in 22 engineering colleges, and M. Tech, / higher level programmes in 12 institutions. Fourteen institutions offer 3 year master's programmes in computer applications (MCA). One year - one-and-a half year Diploma programmes in computer applications are available in 15 universities and 16 polytechnics. Training programmes for console operators (1-year duration) and data preparation assistants (6 months) are offered in industrial training institutes. Other non-certification programmes are also offered by commercial establishments. However manpower requirements far exceed availability of specialists at all levels. Efforts have been made to extend the number of training opportunities but these have been hampered by shortage of trained teaching manpower.

The following institutions are involved in computer education:

a) Five Indian Institutes of Technology at Bombay, Delhi, Kharagpur and Madras;
b) Jadavpur University;
c) Indian Institute of Science, Bangalore;
d) Tata Institute of Fundamental Research, Bombay;
e) National Council of Educational Research and Training (NCERT) at New Delhi and Mysore;
f) Many Engineering Colleges and Technical Teacher Training Institutes are getting started on either development of hardware or software for school use; and
g) Many software houses and manufacturers of computers have shown interest in developing educational software.

Note: Since the entire school-computer programme is designed to be teacher centred to derive maximum effect, (as against computer scientist centred) NCERT, New Delhi will be the model agency for co-ordinating research and development activities for developing educational software.

Present trends and issues

Policy and formal education

Present thinking favours use of computers in general education to prepare children to cope with the present and future technological environment. The objectives of the pilot project recently launched stress the need to de-mistify computers, familiarize students with the range of computer applications and develop a degree of ease which would be conducive to individual creativity, and to encourage teachers to use the technology in improving the effectiveness of their teaching. The emphasis is on use of software packages which do

not seek to displace the teacher in his traditional role but to reinforce him and enhance his capabilities.

Training

In view of the shortage of trained specialists as well as teachers to run training programmes, steps are being taken to create a training infrastructure in more universities, engineering institutions and polytechnics. Shorter duration courses for conversion of teachers in other disciplines are contemplated to make up the shortage, as well as incentive measures to attract professionals from industry to teaching institutions for part-time teaching / faculty association on visiting fellowships etc, and motivate more graduates of high level programmes to take up teaching.

Innovations

Current activity includes development of low-cost rugged, tropicalized hardware through indigenous effort, processing capability in Indian languages and associated alphameric and graphic display software, adaptation of generic software to Indian languages, and development of audio-visual software and other support material for training teachers and students.

Future development

Formal education

Future trends include development of indigenouse CBL packages, facilities for capture of software through broadcast to afford easy dissemination and error-free replication of software, use of school computers in laboratory, and robotics to illustrate control application of computers and tools to incorporate 'Help' features in packages to make themselves instructional.

Non-formal education

Mobile vans equipped with computers would be used to overcome infrastructural handicaps and teacher shortage / inadequacies and promote wider interest among the public.

Training

Elements of computer education would be incorporated into pre-service training programmes and in-service programmes would be expanded to cover larger numbers. Use of mass media is also envisaged to augment teacher-training / support instruction.

Background

Government policy

In Japan there exists no government policy introducing computers into schools as of August 1984. But after the Consulting Committee to the Division of Learning Information, Bureau of Non-formal Education, Ministry of Education, Science and Culture, published in March 1984 the Standard Curriculum Guide for the Training of the Educational Usage of Microcomputer (Intermediate Report), several local governments started to plan to launch computer curriculum for teachers and students. Besides these there are many volunteer groups of which have been conducting computer training courses with the assistance of the faculty members in the teacher training universities.

Developments, trends and issues

Already in 1977 personal computers were available for the cost of a high fidelity audio system or a set of encyclopedias, and the technology continued to bring costs down, or in the case of personal computing, dramatically increased the capability without increasing cost. The computing power of today's largest university machines will be literally placed in the hands of individual students within twenty years. The the capabilities of today's microcomputers will be common place in the laboratory equipment and library aids of the schools and colleges of tomorrow.

It is difficult for the education society to keep pace with these great strides in technological development. In the postwar period for high economic growth was actually a period of technical application rather than technical creation. Yet we all know, education society was forced to undergo great changes. It is expected that a change in the more fundamental social system will be needed when new technology is created.

In addition to this, the fifth generation computer will appear in the meantime with an artificial mental capacity close to that of the human brain, and will be able to think and solve problems by itself. It will be able to communicate with people through language and also to act as a simultaneous interpreter. The computer, when completed, will make the information society even more advanced and complex. When the computer becomes able to engage in intellectual work, people will need higher thinking ability than before. The day may come when the computer's intellectual ability will surpass that of man. Therefore, it is also expected that a greater change in the role of teachers and education itself will be needed when the fifth generation computer appears in society.

Constraints

Also in Japan like other countries, we have economical, physical and human constraints. But due to the co-operation of the Ministry of Education, Science and Culture; Ministry of International Trade and Industry; and Ministry of Postal and Telecommunications in many ways, we will in the very near future solve these problems we are now facing; microcomputers will be distributed to a certain schools, and many teachers will become familiar with micros in education with a certain assistance of these Ministries and private companies.

Professional societies

Council of National University Centres for Educational Technology plays one of the vital roles in promoting the research and development on micros in education as well as educational systems development in general. Other professional societies are the: Japanese Society of Science Education, Japan Society of Electronics and Communications, Japan Society of Audio-visual Education, Japan Society of Computer Assisted Instruction and Japan Council of Educational Technology. By December 1984 another professional society on educational technology, Japan Society of Educational Technology will be organized.

Status of computer use

Computers have been used in education since the sixties, yet it is the advent of the microcomputers in the recent years that have opend up a wider scope for their use in the instructional systems and triggered off a drastic increase of research in this area.

At present, the microcomputer has three distinct roles to play in education in Japan, namely learning about the microcomputer, using microcomputer to process research data, and using microcomputer to assist the teaching-learning processes. Of these the first one refers to computer literacy, and the last one refers to CAI, CMI and microcomputer assisted audiovisual education.

Manpower needs and training

The large number of teachers who are familiar with micros in education, have almost all been trained voluntarily and/or by themselves. But we need more and more teachers and specialists in the field of micros in education in order to promote the schools in the advanced society.

Institutions involved

At least one Teacher Training Universities numbering more than 50 are located in each prefecture in Japan. Of these, 35 universities have Centres for Educational Technology and/or Centres for Teacher Training and Guidance. Along with certain institutions like Tsukuba University, and the Tokyo Institute of Technology, they have formed the Council of National

University Centres for Educational Technology. Besides this several private companies have their own institutions to promote computers in education and training personnel.

Present trends and issues

Policy formation

The ministries, concernned with education for the future, are :- (i)Ministry of Education Science and Culture, (ii)Ministry of International Trade and Industry, and (iii)Ministry of Postal and Telecommunications. But it is mainly the Ministry of Education, Science and Culture, especially the Division of Non-formal Education, which is responsible for the computers in education affairs. The other two Ministries would be in the roles of assisting and /or promoting the Education Ministry from the technical and communication sides. So three Ministries are co-operating to develop education systems. Indeed under each Ministry many advisory groups are existing to support education systems as well as future society in general.

Formal education

Based on the Standard Curriculum Guide by the Ministry of Education, Science and Culture, several local governments as well as well-organized voluntary groups school teachers and study groups in the universities have been developing computer literacy and awareness programmes and computer sciences programmes for primary and secondary students and teachers at both pre-service and in-service training levels. Besides this, computer sciences exists in the curriculum in the upper secondary and tertiary level as a subject with many topics.

Non-formal education

There were 20 Audio-visual Centres and 926 Audio-visual Libraries in Japan as of May 1984. Several centres and libraries are concentrating on computer literacy programmes for not only children but also citizens and teachers. Several universities are opened to the public to train in computer education with the assistance of Ministry of Education, Science and Culture with special reference to hands-on experiences and training on computer programming in BASIC language in general. On the other hand, micros are being used in libraries, city halls, museums, etc, as a tool for learning especially for continuing learning and at the same time as a tool for promoting the activities by the public.

Special education

There are many projects, some of which are within granted by the Ministry of Education, Science and Culture, conducted by the researchers and teachers in the field in order to help mentally and physically handicapped children and adults to study. Many research and on-going papers have been presented at

conventions. As for the gifted the application of research on using micros in the teaching-learning processes has been developed in private sectors, especially in juku (or cram schools), which are one of the best markets for the companies.

Training

i) Technical

Many companies have been conducting Workshops for not only their machine-users but also those who want to study micros as well as mini and main frame computers. In schools, especially in vocational schools, information sciences have been being taught to make the students familiar with software as well as hardware. In upper secondary schools, under the subject matter of mathematics, computers are taught as one of the options mainly stresseing programming.

ii) Teachers

Ministry of Education, Science and Culture established the Curriculum Guide in March 1984 to promote the training of teachers as one of the subjects in a national level Audio-visual Workshop, which has been conducted once a year by the Education Ministry. Many prefectural and municipal science centres and education centres have started to train teachers, developing their own CAI systems.

Innovation

Ministry of Education, Science and Culture, and academic societies like Council of National University Centres for Educational Technology, Japan Society of Audio-visual Education, etc., have been playing vital inovative roles in the education systems in general with the use of micros and other training materials such as VCR, Video disks, TV sets, etc. Several companies also supply schools and other formal and non-formal institutions with many new information technologies.

Brief statistical statements

In 1984, the Ministry of Education, Science and Culture conducted a survey on the computing facilities in the local schools. According to this survey as of May 1, 1984, the percentages of schools equipped with microcomputers was only 0.6% of the elementary schools and 3.1% of the lower secondary schools. However, the percentage is much higher in upper secondary schools, at 56.4%. The same survey also includes the data from the various facilities catering for social education such as in public halls, libraries, museums. The percentage of these facilities having microcomputers range from 0.5% to 10.3%.

Regarding the uses of microcomputers in schools with computing facilities, it was found that 70% of the elementary schools use microcomputer in CAI, but 70% of the lower secondary schools and 63% of the upper secondary schools use them in CMI. Among some of these schools, microcomputers are also being used in computer

literacy classes or club activities. Seventy-eight of the microcomputer in facilities for social education are being used for CMI.

The above data seems to give the impression that microcomputers are not popular in Japan. This could be true to some extent in the school setting, but it is certainly a true reflection of the extent to which researchers on the educational usage of microcomputer are being carried in Japan. Over the past few years there has been an increasing interest in researches on the microcomputer and its educational usages.

Most of the research papers in this area, specially in CAI have increased significantly in the past three years. Many microcomputer based upon CAI system have been developed recently by commercial firms or university research groups. These systems are less costly than the minicomputer based system.

Some of the systems are been installed in some selected schools and are currently being used for teaching subjects such as science and mathematics.

The development of courseware in the form of writing computer programmes has been carried out not only by the commercial firms researchers but also by individual teachers on their own initiatives and by research groups in many universities. Most of the programmes are written in drill and practice or simulation modes for subjects such as mathematics, physics, languages and engineering. Though there are various kinds of programmes, when it comes to the quality of the programme there are few that promote the efficiency as well as motivation of the students.

Future development

Formal education and non-formal education

With the compilation of the research findings and development plan of so called artificial intelligence (AI) computers hardware/ software which would be utilized in the form of combining other devices like VCR, Video disks, etc. in formal/non-formal education institutions, and high quality courseware/software distribution system as well as its development system will be formed under the guidance of Ministries with the clearance of problems like copyright, privacy, etc. which we are now facing. The final report of the Curriculum Guide and its detailed handbook for teacher training also will be available to train more teachers in pre-service and in-service levels systematically. Research on computer literacy and/or computer awareness curriculum for not only children but also citizens will come out to meet a certain need in the coming society. The formal and non-formal education system might change gradually due to not only the development of media, which could be utilized in institutions, even in homes, but also the changes of ideas on education itself. It could be said that the standard for distribution of teaching materials would be modified with the reflection of the research on media and teaching and learning processes.

Training

In any institutions, including homes, as a kind of learning place in the coming society with the use of on-line learning systems through for example telephone line, computer training might be available in various levels. Spreadsheets and training packages with high quality will come out to meet the needs in each level of training. At the same time teacher certificate programmes might be changed with the reflection of introducing micros in education as well as society. The education method and content also might be changed to meet the needs in society.

Innovation

Besides the training of children, training of adults might be needed to make them familiar with the information society which would be marked by both micros and telecommunication technologies. Children like to use such new machines as micros or even game machine in nature, but the adults, on the other hand, might feel as if were outside the computerized society if they were not trained.

Background

In Korea the need for computers was first voiced in the late 1960s. The IBM-1401 Computer was introduced in 1967 by the Statistics Bureau of the Economic Planning Board to process the census data.

In July 1970, by the Presidential order to 'provide Computer-Education in high-school and post-secondary education', the Ministry of Education in collaboration with related government bodies, outlined 'the computer education plan' which might be taken as the initial policy effort toward computer education. Since then, computer education has been introduced in the commercial and technical high-schools.

Computer education is presently implemented from elementary school to universities, by the decision of the Ministry of Education in 1983.

Present trends and issues

Computer education in formal schools

a) The Ministry of Education built up educational policy for stimulating computer education at elementary and secondary school level.

b) Some guideline books for computer education were developed by the Ministry of Education and provided to elementary and middle schools, and academic high-schools in 1984.

c) Computer education at commercial and technical high-school is included in the curriculum as a compulsory requirement and/or option.
More than 40 universities/colleges have established departments related to computer education including computer science and information processing.

d) Hardware for computer education can be provided to the schools at reasonable prices but appropriate software programmes are not developed and provided.

Teacher education for computer education

a) Some teachers from elementary and secondary schools have been trained for computer education for the summer vacation of the last few years.

b) Each provincial board of education presently provides in-service teacher training programmes for computer education to elementary and secondary school teachers.

Future development

Formal education

a) Standardized curriculum and textual materials will be developed for computer education including elementary and secondary schools, and commercial and technical high-schools.

b) CAI and CMI programmes for elementary and secondary schools will be developed in some subject areas.

Training

The Ministry of Education will make a plan for pre-service and in-service programmes for computer education teachers.

Background

Government Policy

In the past, there has been no government policy spelled out on computer technology, its acquisition and applications.

Developments trends and issues

Computer technology was first introduced into Malaysia in 1966 and the use of computers increased rapidly. By 1982, more than 800 computers and 2,166 micro-computers were already in use. The growth in the private sector far outstripped the public sector but due to the introduction of smaller, less expensive machines which could handle the data processing requirements of smaller government agencies, growth in the public sector began to develop more quickly. Generally the annual increase in the number of computers in Malaysia is around 25 per cent. In the midst of this proliferation of computers, management information systems emerged in Malaysia in the mid-1970s in the areas of health administration, agriculture, land administration and finance. Various bodies were set up to control the acquisition of computers and ensure their effective utilization in the context of encouraging the adaptation of computer technology supportive of national goals.

Constraints

Budget constraints in the face of economic necessary conditions have presented difficulties in the form of inadequate financial provisions. Other constraints include lack of understanding of computer applications, difficulty of access to data and incompatibility of software.

Lack of computer personnel to man and operate the large number of computers in the country is especially a problem in government Ministries / Departments.

Status of computer use

The applications of computer technology are largely in the areas of management, planning and research.

Manpower needs and training

Manpower requirements in the government sector for 1984 are estimated to be almost 6,000 personnel of various categories. There is big demand for University and College graduates and High School Students. For the years 1980-1984, the institutions of higher learning could only supply about 30 per cent of the computer science graduates needed. Recently a substantial number of private schools have begun to conduct a variety of computing

classes. The graduates are employed by private firms to work as programmers and analysts.

Present trends and issues

Policy formulation

A national computer policy is in the process of being formulated to establish the overall objectives of computerization and assign areas of priority. Appropriate strategies consistent with national goals will be identified to ensure more effective use of computers, particularly within the public sector.

Formal education

Institutions of higher learning are giving courses in computer science. Undergraduates in areas other than computer science are encouraged to take the course together with the general degree in computer science. Now the institution of higher learning (six universities and MARA Institute of Technology) are churning out Computer Science graduates with Diploma, B. Sc. Degree, Post-Graduate Diploma and Diploma Systems Analysis.

Training

The National Institute of Administration conducts regular in-service courses in computer science at Diploma and Certificate levels for systems analysts and programmers for government agencies and statutory bodies. The Institute also organizes computer appreciation courses for senior management personnel.

Innovations

All teacher training colleges are introducing a modular concept of learning using self-contained instructional packages.

Future developments

Formal education

a) All universities are taking steps to develop their own areas of specialization in computer science courses / studies / research activities.

b) Computer education will be introduced in secondary schools. A pilot project, involving 280 schools, will be carried out for 2 years beginning 1986. This project will be closely monitored by the Curriculum Development Centre.

Background

Government policy

a) As stated in Letter of Instruction 1380 of President of the Philippines, the government encourages computer literacy and familiarity as well as the utilization of computers in government, education, industry and acquisition of computers below 2 million pesos. It also removes the need to get a clearance from the National Computer Centre for the private sector as well as for the government acquisition provided the government acquisition is below 2 million pesos.

b) Letter of instruction 1381 creates an ad hoc cabinet sub-committee to review the role and potential of computers in the development of the economy. It also creates a technical committee to assist the cabinet sub-committee.

c) In the tertiary level, a 3-Unit Computer and Society course has been included in the general education curriculum.

Constraints

Economic problems limit the acquisition and importation of hardware and software.

Qualified teachers are also unavailable for a nation-wide implementation of computer literacy.

Professional societies

There are three professional societies in computers and several student / children clubs. Membership is mainly voluntary with activities ranging from holding programme contests to tutoring fellow students. The professional societies have been actively involved in industry studies, policy recommendations and computer awareness programmes.

Status of computer use

The number of computer facilities have been increasing with an average growth rate of 29.5 per cent in 1971-1980. By 1980 there were 327 systems (excluding micros); 79.7 per cent in the private sector and 20.3 per cent in the public sector. Education and manpower training users comprised 3.76 per cent.

Manpower needs and training

The total number of computer personnel in 1982 was 6,744 while the additional number required was 4,961.

Projecting the additional manpower needs, the NICE Project has given the following table in 1982:

	Manager/ Supervisor	Systems Analysts	Programmers	System Programmers
1981	146	226	458	30
1982	154	244	489	33
1983	147	227	461	30
1984	149	231	466	31
1985	147	227	461	30
TOTAL	743	1,155	2,335	154

Institutions involved

a) Government Agencies
   i) Ministry of Education Culture and Science (MECS)
   ii) National Computer Center (NCC)
   iii) Technology Resource Center (TRC)
   iv) Development Academy of the Philippines (DAP)
   v) Naional Manpower and Youth Council (NMYC)
b) Private
   i) Computer societies
   ii) Schools, Colleges, Universities
   iii) Computer industry
   iv) Training Centres

Present trends and issues

Policy formulation / process

Recommendations can come from any sector or agency and are submitted to the different government agencies concerned.

Curriculum development

MECS is now using a standard minimum requirement for different degree offerings including, Computer Science, Information Systems, Computer Engineering, Business and Electrical Engineering.

The curriculum development process includes MECS, academe and industry plus other government agencies.

Non-formal education

There are currently 145 computer training centres offering courses in computer fundamentals, programming, systems analysis and design and computer operation. Computer users offer in-house training programmes while computer suppliers offer training programmes with respect to the use of their products.

Training

Technical training, which is product specific is mostly undertaken by suppliers. Other types of technical training are provided by universities and agencies like the National Engineering Centres and National Computer Centres.

Teacher training started more than two years ago provided by universities. The effort was organized in 1983 into a project in which MECS is involved. To date about 500 teachers in the tertiary and secondary level have undertaken this.

Innovations

A Master Science Teaching major in Computer Science has been started by Delasalle University to help develop qualified teachers. The first batch of graduates will be in May 1985.

Future development

Formal education

Study for the inclusion of a computer literacy programme in elementary and secondary education is being undertaken.

Non-formal education

A government regulation to ensure good quality graduates from training centres is now implemented.

Training centres, users and suppliers will continue to provide skill / product specific training.

Teacher training programme

A three-phase training programme for teachers will be undertaken. The first phase involves a 2-week crash course wherein teachers study different aspects of computing. The second phase involves the actual work of teachers in a systems development project. Phase III involves the training of fellow teachers to be conducted by teachers who underwent Phases I and II.

Innovations

Research and development centres in selected universities will tie up with private computers to undertake projects in software and hardware interfacing.

Television programmes on computer literacy which have been showing once a week for two months will continue and increase in rating.

Background

Government policy

Singapore is a small nation with hardly any natural resources, other than her 2.5 million people. To maintain the high rate of economic growth, we have to move to higher technology based industries and services. The key to success in the switchover to the new industries lies in preparing our people to acquire the new skills that are required. The most vital new skill is the use of information technology or computers.

In March 1980, a Ministry Committee on National Computerisation (CNC) was appointed by the Singapore Government to formulate a strategic plan to establish Singapore as a centre for computer services.

Developments, trends and issues

In september 1981, the National Computer Board (NCB) was established to implement the strategic plan formulated by CNC.

The National Computer Board has three major statutory functions. They are :

i) to implement the computerisation of the Civil Service;

ii) to coordinate computer education and training; and

iii) to develop and promote the computer services industry.

NCB's first priority was to build up a pool of computer professionals to meet the operational requirements in the implementation of the projects under the Civil Service Computerisation Programme. In the area of developing and promoting the computer services industry, an Industry Development Department was established in March, 1982 to develop and promote the computer services industry.

Professional societies

NCB has the statutory responsibility to set and maintain professional standards through examinations and national certification. A Professional Examination Secretariat was set up in May, 1982 as an executive arm to implement these policies.

Status of computer use

Computers have been extensively used in the various projects under the Civil Service Computerisation Programme. In the private sectors many big companies have been using computers for many years.

Manpower needs and training

To address the shortage of computer manpower, three computer training institutions - the Institute of Systems Science, the Japan-Singapore Institute of Software Technology and the Centre for Computer Studies were officially set up in December 1981, February 1982 and December 1982 respectively. Together with the Computer Science Department of the National University of Singapore, these institutions will be producing the bulk of the computer manpower requirements for the country.

Present trends and issues

Policy formulation

NCB has a board-level committee that looks into computer education and training matters. This committee comprises Board members and representatives from professional bodies, a number of government-sponsored computer education institutes, the National University of Singapore and the Ministry of Education as well as representation from the Board's own Professional Examination Secretariat. The committee advises on manpower planning, education programmes, the establishment and maintenance of professional standards.

Formal education including curriculum development

i) Since 1981, the Computer Science Department, National University of Singapore has increased its intake of students with an aim of producing some 200 graduates per year from 1985 onwards.

ii) The Institute of Systems Science provides training for public and private sector computerisation through innovative programmes in Quality Management Education, Advanced Technical Training, Consulting Service and Applied Research in information systems.

iii) The Japan-Singapore Institute of Software Technology was set up to facilitate the transfer of Japanese information technology to Singapore. Opened in February 1982, the institute accepts students with at least GCE 'A' level qualifications for their two-year full-time training courses in programming and systems analysis.

iv) The Centre for Computer Studies was set up as a joint project between Ngee Ann Polytechnic and International Computers Limited of the United Kingdom. It was opened in December 1982. The institute offers computer courses for both GCE 'O' and 'A' level school leavers. 'O' level students will undergo a 3-year diploma course while the 'A' level students undergo a 2-year course.

v) At Junior College Level, Computer Science is offered as one of the Advanced Level examination subjects of the 'A' level Cambridge GCE Examinations. There are 11 Junior Colleges and about 1,000 students are offering the subject each year.

Non-formal education

Computer Education is introduced to secondary school students through extra curricular activities. One hundred and thirty-for secondary schools have set up Computer Appreciation Clubs each with 3 micro-computers. About 700 teachers have been trained to supervise the Clubs' activities . At present, about 13,000 students which is 8 per cent of the total population of secondary school students have been enrolled as member of the clubs.

For the man in the street, micro-computer appreciation classes have been organized by the People's Association, the National Trades Union Congress and the Singapore Armed Forces Reservist Association. These classes promote computers awareness throughout all levels of society. Between the three organizations, over 30,000 people have undergone various micro-computer courses ranging from basic micro-computer appreciation courses to courses that teach participants programming languages.

Future development

Formal education

The various institutions will continue their efforts to produce the trained computer professionals required in both the public and private sectors.

Non-formal education

There are plans to increase the membership of Computer Appreciation Clubs in secondary schools to 20 per cent of the student population and to introduce computer awareness courses to all secondary students.

Background

Government policy

Following the declaration by His Excellency the President in February 1983, of the need for Sri Lanka to 'leap frog' into high technologies, the Computer and Information Technology Council, (CINTEC) was set up. CINTEC is expected to play a guiding role rather than a regulatory one. This has identified, among other things, the importance of computer education in schools leading to computer literacy and the provision of facilities in the Universities and other Institutions of higher learning to produce expertise in this field. The Ministry of Education and the Ministry of Higher Education are responsible for the activities in the respective sectors. The latter is co-ordinated by the Sri Lanka Inter University Computing Committee (SLIUCC).

Developments, trends and issues

Although the first of the computers were installed in the mid 1960s a number of factors inhibited expansion. The major factor was the restrictive import and trade policies. This inhibited commercial development and growth and TV broadcasting was not begun until 1979. After these restrictive policies were lifted in 1977 the necessary societal infrastructure began developing. As the products of the electronic revolution were being adopted at an accelerating pace by commerce and industry, the lack of preparatory anticipation by the education sphere became an issue. Some Universities, notably, Colombo, Moratuwa and Peradeniya gathered expertise and developed the necessary capabilities, but the school system including the technical school network ignored technician level training. By the end of 1983, a programme was operational with 108 large schools teaching science courses at the General Certificate of Education (Advanced Level) provided with microcomputers, and about 200 school teachers from six teacher training centres trained to initiate the programme. The Ministry of Higher Education has also provided funds for the purchase of 20 microcomputers of moderate capacity per university. In addition some donors and vendors have donated about 25-30 microcomputers to some Universities.

Constraints

While lower level expertise can be met by crash programmes, such as that designed for the schools and those assembled by the private sector, the expansion of the higher level expertise, owing to the long training required, will not be fast enough. This is further aggravated by the

continued out migration of the expert personnel on the one hand and the absorption of trained personnel by the private sector as management personnel on the other. The economic constraints will remain as long as the basic needs are not met even though the wherewithal for the provision of these needs comes from developed technology. The general level of the country's education except in the knowledge of English is high enough and is therefore not a constraint.

Professional societies

The Computer Society of Sri Lanka (CSSL) was established in 1977 and has a membership of about 600. Presently it is involved in influencing policy making and is active in promoting the profession. Seminars, symposia and exhibitions are organized by the CSSL. It also conducts the B.C.S. examinations.

Status of computer use

The first computer was installed in 1967 at the State Engineering Corporation, followed by that at the Examination Department. A few public sector and fewer private sector organizations went into computers in the intervening decade. Some of the departments of the universities also obtained computers. The public saw the computer only in batch processing applications such as processing of examination results. Today there are more than 1000 microcomputers and about 100 minicomputers and main frames. The former are mainly used in schools and offices while the latter are in use in large public sector departments and corporations and in commerce. Of these, 187 Sinclair Spectrums, 5 Commodore 64s, 5 Commodore Vic 20s, 1 BBC and 4 Acorn Atoms are devoted to the school programme.

Manpower needs and training

A recent survey shows that there are about 500 specialized personnel already and that the demand is expected to increase four-fold over the next five years. Even at present there is a serious shortage of senior personnel with computer skills. However there is no concerted effort to train the numbers that are required by the country in the future, although some universities are taking certain steps in this direction. The private training institutions have become the major suppliers of lower level skills during the last few years.

Institutions involved

Among the major institutions involved are:

a) The Micro Electronics Education Unit of the Ministry of Education;
b) University of Colombo;
c) University of Moratuwa and Arthur C Clarke

Centre;
d) University of Peradeniya;
e) Open University of Sri Lanka;
f) University of Kelaniya, Sri Jayawardane Pura, Jaffna and Ruhuna;
g) National Institute of Business Management;
h) Computer Society of Sri Lanka;
i) Computer & Information Technology Council; and
j) Sri Lanka Inter University Computing Committee.

Present trends

Policy formulation

Policy formulation at the highest level is overseen by the Presidents Office through CINTEC. School level policy formulation is conducted by the school Micro-Electronics Programme committee chaired by the Minister of Education. The policy regarding schools is to keep the subject:

a) computer-literacy oriented and general;and
b) elective and not examination oriented.

The expansion will be in stages from the upper end of the school structure, due to logistical reasons, although mindful of the advantages of primary level exposure.

Formal level curriculum development

A teacher training programme and student syllabuses have been prepared. Curriculum developers will be chosen from the teachers and other educational personnel already trained. They will work at the CDC and at the Training Centres in collaboration with the Universities and Computer Suppliers. Some reliance will be placed on the courses developed by other countries, such as the BBC/NEC courses.

Non-formal

No specific plans have been drawn. The computer club facility provides a non-formal mode. The Open University is also offering computer-associated courses. Certain Universities are organizing awarness and literacy courses for the public at large.

Training

The mode used for teacher training is completely outside the institutional set-up. The training is directed by competent university personnel with the assistance of computer suppliers. The specialized training is undertaken by the universities, professional institutions and in-house training by vendors and end users.

Innovations

The major innovation is the teacher training scheme designed for the school programme.

Statistical statement

The pilot school programme began with 108 schools and will be extended soon to all the 475 schools teaching science at GCE (A/L). The next phase is the extension to 1,500 A/L schools. Because the target schools were chosen for the initial exposure, about a third of this segment can be covered through these schools alone. The total enrolment at this level is 200,000 out of a total of 3.4 million.

At the tertiary level, all universities are equipped with at least 20 microcomputers although there are some universities currently using as many as 50.

Future developments

Formal education

The software already obtained is sufficient to explain how the microcomputers can be used in the expanding school programme. The courseware is sufficient to make the students familiar with the uses of the microcomputer. The club activities and the 'Newsletter' will promote students and teachers initiatives in simple software development. CAI and CBL applications will invariably follow the present developments.

In tertiary education several universities are planning to set up teaching departments of computer science and technology offering degree courses in computer science. There is also a plan to develop a LAN linking universities and research institutes in the country. The local integration of a microcomputer system is also under consideration.

Non formal education

The purchase of home computers and the proposed ETV broadcast courses will help non-formal education in this field. Already one community organized facility is available in a suburb of Colombo.

Training

It will be better to continue the present mode of teacher training, with university export direction and in collaboration with the suppliers of equipment, rather than institutionalizing it through the teacher training college network. Curriculum innovations have lost their vitality at the stage when institutionalized teacher training has taken over.

Innovations

The greatest exposure is possible when the microcomputer comes into the home environment. Since economic constraints will not permit this on a large scale in developing countries, a fruitful innovation will be the institution of a lending

system set-up through public or community initiative. The media especially TV can supplement the material provided by self-learning packages.

Background

Government policy

Computer education is the key to achieving the level of expertise, awareness and literacy required to utilize computers in national development.

Development, trends and issues

Computer education in Thailand started 20 years ago at Chulalongkorn University and the National Statistical office . At present, there are five major groups providing computer education in Thailand. They are state Universities, the private computer schools, vendor companies, user organizations groups and a group of commercial and secondary schools.

Professional societies

There are many computer associations in Thailand, but the Computer Association of Thailand, plays the key role in providing computer education and computers for education.

Status of computer use

All state universities have minicomputers or larger.
The computers in these institution are mainly used to support the administration function and for computer education as well.

Manpower needs and training

It is estimated that not more than 5,000 students have taken at least one computer course during undergraduate study. There are two graduate curricular courses with strong emphasis on computer science.

Institutions involved

There are 15 Institutes of Higher Learning and the universities involved.

Present trends and issues

Policy formulation

The Ministry of Education has established a policy for teaching computers in the upper secondary schools and vocational schools. The main objective of the computer teaching programme is to develop basic understanding of a computer system.

Formal education including curriculum development

The Institute for the Promotion of Teaching Science and Technology (IPST) is responsible for developing the computer curriculum, developing teaching material, teacher training, follow-up and evaluation. Two computer courses will be

implemented throughout the upper large-size secondary schools in May, 1985.

Non-formal education

It is estimated that over 20 private computer schools in Bangkok are currently in operation. Almost all of them concentrate on microcomputers. Over 2,000 people are believed to attend such courses annually.

Training

The Department of Teacher Education is responsible for training teachers for the Ministry. Sixty teachers will be trained by each of the Teacher Colleges each year.

Future development

Formal education

The computer education curriculum in primary level will be implemented.

Non-formal education

The number of private computer schools will increase, especially outside Bangkok.

Training

In 1985 the Department of Teacher Education will begin the project to train teachers for the two years certificate and conduct in-service training at the same time.

Innovation

IPST will produce more teaching material for public and private schools.

Chapter Three

TRENDS, ISSUES AND POLICIES ON INFORMATION

This chapter comprises the deliberations and finding's of Working Group A and focuses on general policy issues relating to informatics. Some consideration is given to the range of practice in educational computing encountered in the countries of the region, as well as to what the term computer education implies. Broad trends in the use of computers across the countries represented are identified. These trends include the use of computers in society at large and, more particularly, their use in education at the university and college levels and their emerging use in schools. Certain key issues in computer education are examined and consideration is given to some strategies in developing a national policy on informatics.

Initial considerations

The ten countries represented at the seminar exhibit a wide range of practices with regard to computers in education and in technological development. At the same time differences within countries are sometimes as great as between countries. Any statements, then, that follow about particular countries are broad generalizations ; exceptions can usually be found.

The term computer education in any policy document or curriculum description, unless expanded upon, can be misleading since two rather different meanings may be inferred. Some educational practice tends to place emphasis on the first part of the phrase - the computer - and in this case the term becomes not unlike, say, science education or history education, with the computer comprising the content to be learned or taught. Other educational practice, by contrast, may place emphasis on the second part of the phrase - education - in which case teaching or learning becomes central with the computer as a tool. In other words, a distinction needs to be made between teaching /learning about computers, on the one hand, and teaching/learning with or from computers, on the other.

Trends in computer use

In all countries in the region there has been a dramatic increase in the use of computers (mainframe, mini and microcomputers) in all aspects of society. This is evident in the public sector and, even more so, in the private sector. Computers are being used extensively for payroll, banking, record keeping, decision making and planning. In the educational area computers first began to be used in some countries during the 1960's for processing of examination results. This usage has been extended to include admission procedures, student records, financial management, and so on.

One discernible trend, present in some but not all countries, is a move away from batch processing to the use of interactive terminals. The use of such terminal, together with the microcomputer, has meant that the computer has become more of a personal tool.

Computers have been generally used in tertiary institutions for up to two decades, mainly as research tools, but also to a limited extent for teaching. Research students today often do much of their own data processing and interpreting of results, using statistical packages like SPSS and BMD, whereas formally programming and sometimes interpretation of results was an intermediate step done by someone else.

Increasingly, computers are being networked with the results that users often are unaware of which computer is doing the processing. Local area networks linking mainframe and microcomputers are also beginning to be developed. These developments are tending to make computers more remote. On the other hand, the increasing presence of microcomputers is reversing this tendency by providing more hands-on experience, available previously only in the very early days of computers. The major difference today is that a wider section of the community is gaining familiarity with computers. Indeed, in the more developed countries of the region, few individuals' lives are not touched daily by computers.

In two of the countries, Japan and Australia, experimentation has been underway for several years in providing public information systems, and such a system is under discussion also in India. Japan's CAPTAIN System developed by Hitachi, and Australia's VIATEL System modelled on PRESTEL, are both to be operational soon ; providing the public with information about airline schedules, for instance, train times, entertainment information, stocks and share prices. These information systems represent a converging of telephone, television and computer technologies.

The promises of technology are not without attendant problems. Leaving aside the effects on employment ; one potential problem is the concentration of information in computer memory banks, the ready means of correlating this with other information and rapid retrieval mechanisms. Obvious threats to individuals may be thus posed. Yet another problem or issue is technology transfer. With the livelihood of a nation, from welfare to defence, depending on information stored in computers, there is an understandable reluctance in allowing other nations full access to the latest technological advances.

This section closes in noting the dramatic increase in the use of microcomputers in schools in most countries of the region but especially in Korea, India, Singapore and Australia. Most of this growth has

taken place in 1983 and 1984 and it is expected to accelerate in 1985 and beyond. In China, too, the use of microcomputers, which started in middle schools, is extending to primary schools and is reported to be growing rapidly. The possibly surprising exception to this quite enthusiastic use of computers in schools is in Japan where the approach thus far must be characterized as reluctant.

Issues and problems

The field of computer education, whether it involves learning about computers or learning with or from computers, is throwing up many issues which require the urgent attention of educational policy makers and / or researchers. Some issues extend beyond the educational domain, having implications for manpower planning, for the legal profession and for governments.

The issues that follow have surfaced in some, if not all, of the countries of the region. It is not an exhaustive list and is not presented in any order of priority. Particular issues, such as those relating to curriculum materials and teacher training, are discussed in greater detail in Chapter Four.

Training for business and industry

Universities, Institutes of Technology and tertiary Colleges in all countries are engaged in producing graduates with specialisms in computer science. Most countries report that the needs of industry are not being fully met because a common experience is , first, that needs are continually increasing and, second, that many graduates are being attracted out of the region by greater opportunities elsewhere. Japan alone feels that its institutions are graduating sufficient numbers to cope with the needs of industry though it is felt there that those senior executives in business and industry whose training pre-dates the widespread use of computers, need additional training.

In most parts of the region expanding quotas for computer science in tertiary institutions is not a realistic solution at present because of the region-wide difficulty in recruiting teaching staff to senior positions. An associated difficulty is the shortage of computing equipment for students because of insufficient funding.

Teacher training and re-training

All countries in the region report that too few teachers are being recruited with adequate training to teach or use computers in schools. Nowhere is there currently any compulsory component in the use of computers included in pre-service training.

New training courses are, however, being set up in universities (e. g. the three-unit course on "Computers in Society" in the Philippines) and

generally there are opportunities, at both pre-service and in-service levels, to take such courses as electives. The magnitude of the task though is enormous when it is considered that India alone has 600,000 primary schools and almost 60,000 secondary schools. A compounding difficulty is the shortage of trained teachers at the tertiary level. The staff in teacher training institions and schools of education, perhaps more than their colleagues in other disciplines, are relatively unfamiliar with the new technologies. A major re-training effort thus needs mounting at the tertiary level.

It is noted that the Ministry of Education, Science and Culture in Japan has recently issued a curriculum guide for training in the educational use of microcomputers (Appendix 5). This guide sets forth the general principles and objectives of training, together with suggestions of content and time allocations. Thus it seems that the previous reluctance, observed above, by Japanese educational authorities to promote the use of microcomputers in schools, may have been prompted by the need first to have in place a properly conceived plan to prepare teachers.

Curriculum materials for teacher training

One means of overcoming the critical shortage of trained teachers is considered to be self-training courses available on certain microcomputers. In Sri Lanka, for instance, the cheap availability of such self-help courses for the Sinclair microcomputer was a determining factor in recommending this machine for purchase.

A strong need is felt by several countries for more software of the kind described above for teacher training. An information exchange between countries on course syllabuses and materials is therefore considered highly desirable.

The Australian and Japanese experience is that teaching, programming skills to teachers at least in courses of limited duration, is not particularly successful because student teachers can rarely trasfer these skills to any significant programming problem. An alternative approach is to introduce teachers to generalized programming packages such as word processing, database management systems and spreadsheet programmes. This kind of approach is favoured also in India. However, where such courses have been tried, student teachers often report that the courses lack programming content.

All of the above underscores the importance placed on teacher training by all countries. There is a clear need for a carefully considered rationale and accompanying objectives for using computers in education, a point returned to in greater detail in the next section of this chapter.

A further discussion on curriculum content and resource for teacher training can be found in Chapter

Four.

Quality and availability of software

Availability of educational software poses different problems in different countries. In English speaking countries like Australia and New Zealand, there is an abundance of software for a wide range of microcomputers. Much of this software, however, is thought to be of little value educationally and runs counter to the philosophies and values of many teachers. In other countries of the region, all software has to be produced locally because of language and cultural differences and is therefore much scarcer. In countries such as India with 14 separate languages, software production takes on yet another dimension.

Computers are, of course, of little value without software and thus the availability of quality educational programmes is , together with the adequate training of teachers, the Achilles heel as far as the successful utilization of computers in schools.

The adoption of a standard operating system would alleviate the problems of transporting programmes across different types of microcomputer. Unfortunately, it seems that this must remain a pipe dream for the near future. Japan has attempted to adopt a single standard operating system for microcomputers, MSX , but its disadvantage is weak resolution. In other parts of the world, CP/M and MS-DOS are becoming standards for single users while UNIX may emerge as the standard in a multi-user environment. What is needed is a standard for mainframe-microcomputer communication.

Despite the difficulties of language and cultural differences between countries, and the problems of portability across different microcomputers, there is nevertheless seen to be value in co-ordinating and disseminating information about software production among the countries in the region. The most important ingredient in any computer programme is, after all, the idea behind any programme. Meetings among experts in software design and production is one possibility ; an information exchange of the clearinghouse variety is another.

Determining priorities in purchasing microcomputers

A crucial issue in several countries (e.g. Sri Lanka, Malaysia, India, Thailand) is whether to begin placing microcomputers in some schools while others lack such basic facilities as desks and chalkboards. This is a basic dilemma made more acute by the fact that reluctance to use the new technologies will still not necessarily help the equipment needs of schools in disadvantaged districts.

What kind of microcomputer to purchase and whether to promote indigenous production of computers are yet

other questions for educational administraiors and policy makers. Most countries cannot afford to take expensive options. The question then becomes one of determining whether cheaper kinds of microcomputers can do the kinds of tasks aimed for in a country's educational objectives.

Countries like the United Kingdom and France have promoted locally manufactured computers, usually restricted in number, in order to help with the problem of software production. The problem to be avoided in opting for in-country manufacture is not to shut a country off from the mainstream of educational innovations. Hence, the need for Unesco to continue its role of organizing regional and international meetings in the area of educational technology.

Equality of access

Equality of access to basic education, whether utilizing computer resources or not, is a problem which follows on from the problem of determining priorities. There are several aspects to be considered here depending on the stage of technological development reached in a country.

First, there is the problem of providing equal resources to urban and rural areas. In less developed countries electricity is not available in many rural areas ; even in more developed countries problems of developing computer networks over vast distances are immense.

A second issue relating to the above is that the impact of new technologies in the work place is known to be greatest on the less powerful groups in any community, usually the least educated, migrant groups, women and girls. As far as the latter group is concerned, there is some evidence to show that boys tend to monopolize time at the keyboard and, further, that boys usually have more access to computers because of their frequency of use in certain subjects like science and mathematics.

Other aspects of the equality of access issue concern type of school or affluence of school communities. Affluent school districts are likely to have more micro power than less affluent districts. And there are likely to be more computers in the homes of students attending well endowed schools or universities than in the homes of students attending other institutions.

The equality of access issue has complex ramifications extending also tothe way microcomputers are used in schools. One rather provocative hypothesis that might be tested, for example, is whether schools in higher socio-economic areas use computers to develop problem-solving skills (that is, students programming computers) whereas schools in lower socio-economic

areas primarily use computers for drill and practice (that is, computers programming students).

Ergonomic Considerations

Ergonomic considerations are beginning to surface as issues too. With greater numbers in the work force spending increasing periods of time in front of terminals, industrial and health related questions like source of light, screen reflection, glare, non-stable or flickering images are being raised as concerns.

Other concerns are the effects on the physical nervous system of working at terminals for concentrated periods. This problem is recognized, for example, at the educational management information system centre installed with the Ministry of Education in Thailand. Regular exercises and rest periods are required in between work sessions at terminals.

The effects, too, of radiation from working in the close proximity of terminals, especially colour terminals, is unknown. Yet other considerations relate to furniture and keyboard design- height of desks, type of seating, position of hands at keyboards, even floor covering.

If microcomputers are to be widely used in schools, education policy makers need to consider seriously these ergonomic issues.

Copyright

The question of copyright is another important and complex issue affecting not only software production but also teaching about computers in society. In considering ethical issues, for instance, there is an obvious anomaly in schools discussing with students questions of privacy and the protection of the rights of individuals while at the same time breaking copyright by copying disks.

With regard to printed materials copyright questions are complex enough and the proliferation of photo-copy facilities makes enforcement difficult. For radio and television programmes copyright procedures are less well established and for computer programmes even less so. A landmark amendment of the Copyright Act in Australia has recently brought computer programmes within the scope of literary works. The purpose is to prevent the purchase of computer programmes in one language and their conversion to another without the prior consent of the copyright owner.

While questions of copyright must essentially remain concerns of governments, the issues very much involve the use of computers in society and in schools and so must also be the concern of educational policy makers.

Educational benefits ?

Important as all these issues are, more important is the educational benefit or otherwise of the new technology. This is primarily a research question. Currently, sad to say, there is a paucity of research to guide the use of microcomputers in schools.

How are microcomputer best used in schools ? Are there some subjects in schools where microcomputers are more effectively used than in others ? To network or not to network ? These are just some questions in urgent need of concerted action by research bodies, by individual researchers and, indeed by the whole educational community. as has been noted by two educational researchers : " Unless we conduct some fundamental research now, we may soon be heading in unwanted directions " (Roblyer and King, 1983).

Developing policy

Many of the issues already discussed have policy implications for the use of computers in education. Examination of the country reports in Chapter Two reveals that, even in those countries where a policy on computer education exists, there is generally missing any clearly defined rationale and accompanying specific objectives.

In view of the relatively recent appearance of computers on the educational scene, the absence of any clear rationale is possibly understandable. And yet before computers are thrust upon schools, principally as a result of pressure from computer manufacturers, vendors and parent groups, it is rather important that educational policy makers know why they are being introduced and what it is expected might be achieved.

As a start, it seems sensible to look at what is happening in those parts of the world which have had longest experience in the computer education field. Examination of practices, for example, in the United States, Britain and France, where considerable government support for schools computing is received, shows that computers are introduced as early as the kindergarten and primary years. Australia might also be included in this group on similar grounds (its first schools computer centre was established in 1968 and computer studies was included as a matriculation subject in 1972). On the other hand, other developed countries like Sweden, West Germany and Japan have been much slower to introduce computers across the curriculum.

The most important questions therefore remain. Why introduce computers in schools and why even into primary schools, what are they to be used for and how are they to be used ? In attempting to arrive at some kind of rationale, discussion focuses on three principal questions.

Who are the learners ?

This question may be answered in varying degrees of specificity according to educational conditions operating. One suggestion is that four groups of learners, for whom knowledge about computers and their use is necessary, may be identified :

a) all students at all levels, kindergarten to university ;
b) some students with a special interest in computers but who do not wish to major in computer technology ;
c) technician groups in commercial and technical schools ; and
d) computer specialists and engineers.

A second suggested grouping of learners, not directly at variance with the above but oriented more towards adult working life after schooling is the following :

a) the general public ;
b) computer users ; and
c) computer specialists.

In these grouping of learners, the terms ALL, some and FEW are used purely as descriptors. They may convey some indication of the numbers involved though this will vary according to a country's needs. Obviously, though, the second group (SOME) and third group (FEW) are subsets of the first group (ALL) .

If the second framework is considered reasonable three groups of learners within the continuum of education may be defined more closely and appropriate curricula developed.

a) ALL Students ;
Microelectronics is transforming the work and life styles of all people. The education that we impart today should equip all students for the telecommunications revolution which is changing the environment of everyone.
b) SOME students ;
Some people will work closely with computers, either using them as tools or working in an environment where they interact and communicate with other skilled computer users. Schools need to provide opportunities for some students to develop interests and skills in information processing.
c) A FEW Students ;
There is need for a few people to be highly trained in the various specialisms of the microelectronics industry. The education system needs to prepare a few students to fill these roles.

What are they to learn ?

This question is taken up more fully in Chapter Four. For the purposes of this section, a brief answer follows for the three groups identified above.

a) ALL Students ;
Computer awareness/literacy/appreciation includes being familiar generally with telecommunications of which computers are a part, and having a broad understanding of computers and their use. These are goals for all students.

b) SOME Students ;
Computer fluency implies some degree of competency in interacting with computers, not necessarily developing programming skills but rather developing programming-like abilities. The use of some applications software (e.g. accounting and spreadsheet packages) requires a clear understanding of computer input, data processing, and output. For some students this kind of knowledge of the capabilities of computers is required.

c) A FEW Students ;
For a few students there is a need to be familiar with specialist applications of computers, to be able to design new applications and better means of communicating with computers.

Why should they learn ?

Again an answer to this question is sketched briefly for the three groups identified.

a) ALL Students ;
It is important that all students should
-be comfortable about using computers ;
-be aware of their potential and limitations ;
-be familiar with the range of computer applications in society ;
-know the implications of such applications ;
-recognize the computer's capabilities for storing and accessing information ; and
-be able to cope with the explosion in the amount of information available.

Implicit in these objectives is the real reason why all students should be familiar with the new technologies. Computers provide new and powerful tools for storing and accessing information. Increasingly, as the world storehouse of information is held in the memory banks of computers, it is imperative that all students know how to access this storehouse.

b) SOME Students ;
The number of computer users will grow with advances in technological development. It is important that those who work in computer environments can communicate effectively with technologists, with programmers and systems analysts. For some people a fuller appreciation of the capabilities of computers is thus necessary in order to distinguish between what are reasonable expectations of whatever may be the current state of technology and what is unreasonable.

c) A FEW Students ;

There is a need to produce a better interface between people and computers. This requires software that is designed for the general public and is easier to use. To design and produce such software requires special skills on the part of a few people.

Towards a rationale

The discussion above relating to the major questions ;

Who are the learners ?

What are they to learn ?

Why must they learn ?

does not, of itself, provide a full rationale for computer education. Each of the countries in the region and each education system within the countries must go through the exercise of answering questions such as these for the particular conditions and factors operating within the country. It is through such strategies that policies on informatics may be arrived at.

Chapter Four

CURRICULUM DEVELOPMENT

This chapter is the outcome of the discussion of Working Group B.

In order to have a meaningful discussion of curriculum development in computer education, it is necessary to first identify the different types of computer education that may be provided to different levels of students as well as to different special groups of people including the general public.

Although there are several ways by which computer education may be categorized, the structure that will be presented here has been accepted by the participants for purposes of further discussion. It should also be noted that while educational systems differ from one country to another, the types of computer education and the groups by which these types of computer education may be provided to are still relevant.

When discussing curriculum development, not only should the objectives and contents of the curricular offering be presented but also the strategies by which they may be implemented should be emphasized. Such strategies will be discussed.

Curricular evaluation is another aspect which needs attention and discussion. Although evaluation may be undertaken in several ways, some guidelines will be presented.

Types of computer education

Different types of computer education may be provided, with the contents and methods per type of computer education being used as the basis for classification.

The importance of this categorization becomes obvious when one considers the strategies and processes by which they may be delivered. Furthermore, each type requires the teachers to have different skills and knowledge , implying that different types of teacher training programmes are also necessary for their proper implementation.

Kindergarten to 10 or 12 years

In formal education, the following types of computer education are identified for students in kindergarten to 10 or 12 years.

a) Computer literacy

Under this category should be the application and implications of the computer in society, the depth of which when discussed, will be dependent on the level

of maturity of the students. In addition to this study should be the study of:

i) computer concepts which may be taught without any computer facilities;
ii) software packages such as LOGO, data base management systems, word processors, spreadsheets, etc.; and/or
iii) any form of programming using any of the popular languages or packages such as BASIC, LOGO, PILOT.

The objectives for including the above enumerated areas of study is to provide the students with the following:

i) An awareness of Information Technology and how it affects his/her day-to-day living;
ii) An understanding of man/machine interaction so that he/she may have the confidence to communicate and use computers in a variety of ways;
iii) An understanding of common computer terminologies to make him/her feel "at home" with them;
iv) An initiation on the importance of information so that he/she may later realize the full potential of computers as tools in analyzing and decision making processes; and
v) An understanding of when computers may be used for problem solving purposes.

b) Computer based learning

Using computers for teaching and learning may be more effective than other methods. When such conditions exist, it becomes worthwhile to implement computer based learning in schools.

A computer based approach to learning may be done in several ways. Whatever methods may be used, it is important to realize that learning should be centered towards the topics/areas which are being taught and not to the tool, computer.

Computers may be used to supplement other teaching methods by providing drill and practise type of software in areas such as English, mathematics and physics. That as the situation wherein the patience and consistency of computers will be highly appreciated; thus enabling teachers to create new ideas, concentrate on objectives in teaching and other more important human-oriented types of activities. This type of learning, popularly known as Computer Assisted Instruction (CAI) has been implemented in some places such as Australia and Japan.

On the other hand, to enrich the teaching processes of the teachers, the use of computers may be integrated with other activities in the classroom or outside the classroom. For instance, the use of subject-specific software packages such as database in economic's history, or geography provides an opportunity for the students to appreciate historical

information, analyze historical events and deduce certain types of conclusion with respect to patterns of events, present and future trends. Another example may be in word processing wherein students who are learning the processes of writing may concentrate on the process rather than their spelling errors.

In these types of learning, computers provide opportunities for students to acquire new knowledge and skills through simulation, information handling, problem solving, data analysis, graphics and games.

At the very extreme is self-placed learning wherein students learn on their own with the help of computers, manuals and other facilities. Teachers may or may not act as co-ordinators while students progress from one level to the next through some built-in structure and evaluation in the learning process.

It should be noted that in the three cases enumerated above, computer-based learning is important in order to provide students new tools and techniques which complements or extends existing teaching methods. Computers are not taught as a subject per se.

c) Computer studies

While some students may be satisfied with knowing what computers are and how they affect their day-to-day living, there are some students who would prefer to explore further and understand why computers work. In this type of computer education, the following levels of understanding computer "internals" are enumerated:

i) Programming;
ii) Computer organization;
iii) Systems analysis and design;
iv) Information system;and
v) Computer hardware.

The objectives for providing this type of computer education are to:

i) develop good programming style, to promote capability to analyze problems and develop computer solutions for them;
ii) understand the different components and functions of typical computer systems and how they relate within their environment;
iii) develop knowledge of information systems applications and development of techniques;
iv) make students capable of using software packages relevant to information handling; and
v) make students capable of identifying present and potential uses of information technology.

Such courses may be introduced in different levels of emphasis depending on the thrust of the schools. They are provided for in technical, commercial or general secondary or high schools.

Tertiary

Another important component of formal education is

tertiary level which may also be called university or college level education.

Computer education at the tertiary level may be categorized in the same manner as in the kindergarten to 10 to 12 years education. However, there is a need to redefine the rationale and contents by which they are given.

a) Computer literacy

Since computer literacy programmes in the elementary and secondary levels are not yet universally implemented, tertiary level education should provide programmes as per the contents provided in the previous section. This transitory nature of computer literacy education in the tertiary level implies that the contents of computer literacy programmes should be modified in the future.

It should be noted that this transition period may take several years for most developing countries.

As "Computer and Society" type of courses are provided in the tertiary level curricular programmes, the emphasis of the course/s should be in terms of computer awareness and the social implication of computers. Special attention should be given to how each person is affected by information technology and how he/she may utilize this technology.

b) Computer based learning

Computer use as a tool across the teaching and learning of different subject areas is emphasized in this section.

Curricular revision is perceived to be necessary in order to update the teaching and learning of different degree programmes using computers as one of the tools.

Some of the possible ways by which computer based learning may be undertaken in the tertiary level are through the:

i) provision of drill and practise sets of exercises for skill development;
ii) provision of computers for problem solving purposes such as in mathematics and accounting;
iii) provision of tutorials for individualized instruction;
iv) development and analysis of models, simulation, etc., for different subject areas such as management and decision-making, planning, physics and economics; and
v) development, implementation and use of data banks in order to enable students to realize the implications of information technology in their chosen fields.

c) Computer studies

Computer studies in the Computer Science and Engineering areas include formal education in the bachelors, masteral and doctoral levels. Such degree programmes may have emphasis on hardware and software.

The objective for offering such degree programmes is mainly to develop computer specialists who will be capable of analyzing, designing, implementing, monitoring and evaluating components or whole computer systems or information systems.

On the other hand, a computer science information system may be offered as a component of studies in other disciplines. As such, the degree programmes remain in whatever professional area is being offered, with the main difference being the inclusion of computer or computer related subjects.

The objective for integrating such courses in the curricular offerings of these degree programmes is to integrate computers and their use in the professional areas.

Non-formal education

Computer literacy for different types of groups such as the handicapped, housewives, or The general public may be provided through different types of computer-related programmes such as (i) seminars; (ii) workshops; (iii) exhibitions; (iv) mass media - radio, television, newspapers; (v) computing activity centres, clubs and societies; (vi) libraries; (vii) homes and private studies; and (viii) others.

Since computer literacy for everybody can came in different activities, it will be best for each country to encourage these activities in whatever way they may be undertaken.

Evaluation

In all educational programmes, formative evaluation is perceived to be a necessary undertaking. Computer education programmes being new, accountability in the process of implementation will provide good indication on the programmes' status.

Any form of monitoring exercise in this early stage of development and implementation of computer education is appropriate. The main purpose here is to determine whether curriculum developed fits in the requirements identified or not.

Monitoring certain classrooms can be undertaken.

This implies that funding will be necessary and appropriate.

Another important consideration is the regular evaluation of the curricular offerings in the different categories of computer education. Due to the fast development of computer technology, this consideration is further amplified.

Dissemination of evaluation reports is also very important.

Professional development

In order to implement computer education in any of the categories identified, it is necessary to understand the skills and knowledge that are appropriate for each group of teachers. It is strongly recommended that teacher education in this field be done in collaboration with research and development of computers and curriculum development.

Furthermore, it is assumed that the development of existing teachers would be the best approach in conjunction with the revision or reorientation of education degree programmes to include computer subjects.

For teachers of computer literacy programmes, the following knowledge and skills is necessary:

i) Working knowledge of computer awareness/literacy course gudelines.
ii) Classroom management skills relating to control, use of and equitable access to equipment and its integration into lessons.
iii) Competence in using hardware and software in both demonstration and small group modes.
iv) Skills appropriate for teaching social issues arising from use of information technology. These include discussion, social analysis, use of video and other resources for this purpose and setting and marking of essay work.
v) Competence to run and assess package software, to handle simple faults (power cords, drives needed or not, printer connection, etc.) and care of equipment.
vi) Knowledge of printed and other resources for teaching computer awareness/literacy courses and of sources for keeping this knowledge up to date.
vii) Knowledge of suitable software to support the aims of the courses and of sources of new software.
viii) Skills in selection of suitable software for these courses.
ix) Ability to identify and use general sources of current information about computing as it relates to computer awareness courses.
x) Ability to discuss social issues that relate to use of information technology generally and to educational uses in particular.
xi) Enough computer programming skills to be able to teach programming at the level indicated by computer awareness/literacy course guidelines.
xii) Understanding of and ability to implement good programming practices.
xiii) Working knowledge of the use of the computer as an information handling tool.

For teachers who will use computer based learning in their classrooms, the following skills and knowledge would be necessary:

i) Awareness of the potential of computing in the teaching of the subject; familiarity and understanding of the extent and nature of computer use in the subject area outside schools.
ii) Minimum knowledge (level similar to that suggested for Computer Awareness Teachers) of equipment operation, maintenance and care.
iii) Working knowledge of available software, sources of software, and sources of information to keep this knowledge up to date.
iv) Software selection skills.
v) Classroom organization skills, integration of equipment use into lessons; use of demonstration and small group techniques.
vi) Awareness of changes in curriculum shifts in emphasis due to new technologies.
vii) Ability to discuss social impact of information technology on the subject area.

The identified knowledge and skills were extracted from Teaching, Learning and Computers: 1984 Information Kit of the Commonwealth Schools Commision, Australia.

Pre-service programme

It is perceived that there are two types of education degree programmes that have to be studied.

The first is the teaching of would-be teachers. Degree programmes in education must be studied in terms of the revision of the curricular offerings to include courses in computer literacy, computer programming, computer analysis and design and studies in computer assisted instruction and computer based learning -- what it is, how and when to use and how to develop them.

The second is the development of curriculum in education with a major or minor in informatics or computer science which is basically to produce graduates who are going to facilitate the development of computer based learning, its design and development.

In-service programme

A major constraint prior to actually implementing computer literacy and computer based learning programmes is the availability of teachers who will undertake such programmes. Present existing teachers have to be trained but this task is too big for certain countries to undertake on a nation-wide basis.

A model has been discussed for professional development for computer literacy and general subject

classroom teachers.

Complementary to this model are the development and reproduction of a multi-media package which includes printed materials with their corresponding documentation and some case studies provided in audio or video media.

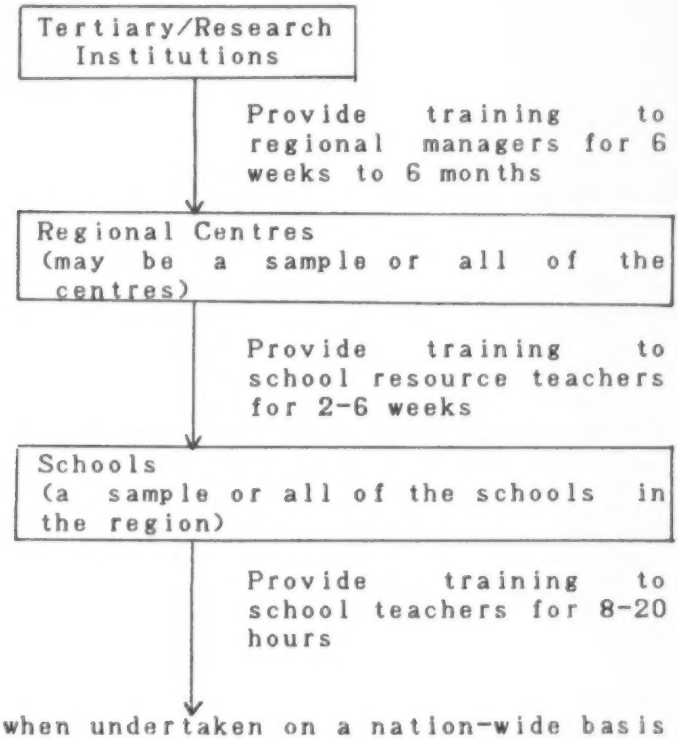
Printed materials include technical instructions, such as how to install the computer and how to run the software, objectives of the programme and readings on curricular matters.

The software and documentation that will be used for the training programmes should be provided. This presupposes that development effort or acquisition of such software was done prior to the teacher training programme.

Self-paced training packages which are multi-media may also be developed and provided to the teachers.

Case studies of individual teachers in audio or video media may provide good ways by which experiences may be shared. Case studies in individual software packages may also provide for sharing of possible ways by which the software packages are used. This opens the way for future development or enhancements of such software packages.

When the above discussed materials are available, the teacher training programme may be provided using the framework below:


Tertiary/Research Institutions
Provide training to regional managers for 6 weeks to 6 months
Regional Centres (may be a sample or all of the centres)
Provide training to school resource teachers for 2-6 weeks
Schools (a sample or all of the schools in the region)
Provide training to school teachers for 8-20 hours

This model, when undertaken on a nation-wide basis may produce problems with dissipation of objectives through the various levels. The quality of training that will be provided to the lower level teachers will then become questionable.

Furthermore, the size of the educational system of the country is highly correlated to the amount of

problems and funding needed for the project.

Due to the magnitude of development effort, the development of printed materials and documentation is a government's concern. In most cases, this should be initiated and facilitated by the government and later, transferred to the private sector for reproduction and distribution.

Another major consideration here is the time of the co-ordinators and teachers who will be involved in the process. A general policy along this area should be provided by the authorities in order to have a meaningful implementation.

In-service programmes for Computer Literacy Courses may not be attractive to teachers unless they have the incentive to find out about computer based learning packages for their respective subject areas. Thus, the development of computer literate teachers may be parallel to development of teachers for the general subject areas.

It has been pointed out that while in the past, mathematics teachers have been initially perceived to be the first group for training the social science and science teachers are now at the forefront due to the vast potential of software packages used in these areas. Furthermore, mathematics teachers have shown very close association with programming which is identified as an unnecessary skill for teachers in computer literacy and computer based learning.

It was strongly pointed out that the training of teachers should not emphasize programming, but instead, the use of software packages. The development of software packages may be pursued by teachers who are interested in that area, but it is not recommended for all teachers to be involved in such.

Software portability

Issues

A major problem of software packages for education is the issue on portability. The hardware and operating systems used are not compatible so that wide distribution of educational software is not possible.

The trend today is to develop CLB packages in a very high level functional language which can be converted automatically, using an automatic programme generator, to programmes for different software and hardware environment. One also specifies a high level language as a requirement for the hardware to run their package. Manufacturers of hardware can usually provide the language compiler if the language chosen is fairly common in the industry.

Distribution media, however cannot be standardized as these will need machine specific devices.

A model for software development

A general approach to software development should be to look at a team composed of a teacher, instructional designer and computer science expert.

This group goes through a set of processes starting with a proposal from a teacher who can use existing CBL packages and gets an idea for a new package. This proposal is studied by an instruction specialist in the subject area (if available), at the regional level. The teacher then prepares a script which detail the screen design, input/output specifications, error recovery needs, etc. This script is evaluated by a review group and modified accordingly. At this stage, the uses of this CBL will be articulated showing the typical seminars or classroom situations by which they will be used. A draft of a users' manual should also be provided. Upon completion of these specifications, a computer science expert checks if the required facilities can be provided and looks at the efficiency of implementing such a system. After discussions regarding this matter have been accomplished, and the script finalized, the computer science group will develop the package. The teacher concerned assists in the debugging of the software. After all these activities have been undertaken, the final manual is written with the assistance of the instruction specialist.

Chapter Five

RECOMMENDATIONS

The participants of the Third Asian Seminar on Educational Technology (Tokyo) after due deliberation made the following recommendations.

To Member States

General

1. That all Member States in the region accept the desirability of universal computer awareness / computer literacy education but with different strategies and time-tables in keeping with national constraints.
2. That at the present stage of development in computer education in Member States it is desirable that computer literacy is given greater priority than computer science or computer studies.
3. Recognizing that most Member States have already made some headway in establishing national institutions for the promotion of computer development, it is recommended that due emphasis be given to computer awareness and computer literacy education.
4. Where conditions permit; computer literacy may be conveyed through the national language and script.

Curriculum

5. a) Computer literacy may be introduced into the school curriculum either as a formal subject or as extra curricular activities;
   b) Computer literacy as envisaged should preferably not include teaching programming language but use of appropriate software packages;
   c) There should be some concern about the danger of single answer linear-type convergent instruction taking over CAI exclusively, therefore the development and adoption of divergent, creative CAI programmes should be encouraged;
   d) In countries where there are too large a number of schools and pupils, techniques need to be evolved to ensure availability of hardware to as many pupils as possible;
   e) As Computer Based Learning based on packages is the approach to improve effectiveness and efficiency of teachers in specific subject areas; CBL packages should be highly related to the context of the school system in terms of syllabus of subject courses, language of instruction, technological environment of the country;

f) Opportunities should be provided for proven subject teachers from countries in the region to meet in workshops and exchange ideas and learn about techniques of designing CBL packages. In this way the computers in education programme becomes teacher centred rather than being computer expert oriented; and

g) The potential of the computer in special education should be more fully exploited.

Teacher training

6. a) That there is a recognized need for extensive teacher training (both pre-service and in-service) in the following areas:

i) Teachers of computer literacy:
ii) Subject teachers using computer based/assisted learning; and
iii) Teachers of computer studies.

The priority should be teachers of computer literacy;

b) Training for teachers of computer literacy and computer assisted learning in school subjects should include familiarity with materials such as LOGO, spreadsheets, data bases, CMI and CAI packages; and

c) That school teacher education for computer education be done in collaboration with the experts in the research and development field in computer in universities etc. and not depend entirely on computer trained teacher educators.

Regional Co-operation (Unesco/ACEID)

Exchange of information and expertise

7. That the participants in this seminar should be asked, on their return, to assist a nominated Associated Centre, or any other institution to prepare a directory concerning existing or planned:

a) Computer training institutions
(including the mailing address, national/international, purpose, programme, language of instruction, available hardware);

b) Computer associations
(including mailing address, priority functions);

c) Computer publications
(subscription address, cost, language, level, intended audience).

This inventory should be submitted to APEID, Unesco ROEAP for compilation as a directory and dissemination; and

d) The participant/institution be asked to continually collect details of publications,packages and research papers dealing with computers in education; and

e) The Centre for Educational Technology of Tokyo Gakugei University should set up an international library of these materials.

8. That Unesco/ACEID convene a meeting of experts and those involved in the use of computers in schools to identify and select 'core' programmes for use in schools at various levels. This is to indicate to commercial producers of software the core needs in this field in the region, thereby inducing their large scale production leading to ready availability and lowering of costs.

9. That Unesco/ACEID convene a meeting of the representatives of hardware producers to:
   i) indicate to them the developments in the education field;
   ii) indicate the needs in the education field; and
   iii) indicate the need for standardization and the development of 'adaptors' for a wider range of equipment.

10. That Unesco/ACEID set up a clearing house for the collection and dissemination of ideas and developments in the school computer field and to publish a Newsletter to facilitate the interchange of ideas in this field.

11. That Unesco/ACEID compile a 'Consumers Guide' for education-related consumers covering both the hardware and software fields. This guide should be comprehensive enough to cover initial costs, maintenance costs, capabilities, upgrading possibilities and accessories and software availability.

12. That Unesco/ACEID organize national level and sub-regional workshops for education and technical personnel to help develop the national capabilities in the school computer field. In this context Unesco/ACEID would play its usual catalyst role.

13. That Unesco/ACEID should make arrangements to share and exchange CAI and CBL courses and software developed in the Member States of the region.

APPENDIX 1.

Greeting by Mr. Nobuo Nishizaki

Speech by Mr. Nishizaki, Deputy-Director-General of Science and International Affairs Bureau at the Opening Session of The Third Asian Seminar on Educational Technology (September 26 1984)

President Abe, Mr. Cahill and our friends from Asia and the Pacific region,
Ladies and Gentlemen,

It is my great pleasure to address at the Opening Session of the Third Asian Seminar on Educational Technology which is jointly organized by the Japanese National Commission for Unesco and the Japan Council of Educational Technology Centres with financial support from Unesco. On behalf of the Ministry of Education, Science and Culture, and also of the Japanese National Commission for Unesco, I should like to extend my warmest welcome to all the participants from countries in Asia and the Pacific region.

This Seminar is a part of the Japanese contribution to the APEID activities. The Asian Programme of Educational Innovation for Development, APEID, is being promoted jointly by 23 member countries of Unesco in Asia and Pacific region. Its contribution to the promotion of endogenous development of education is highly appreciated not only in this region but also in other regions. All the countries in the region are seeking a way to develop the education while preserving own values of their societies. The Principles of mutual learning and mutual assistance based upon equality and self reliance should therefore be laid in the foundation for the regional cooperation. We fully share this idea and wish to contribute to the common efforts.

For this purpose, Japan has been cooperating positively in APEID activities since its establishment in 1974. In these years, Japan has been participanting in the five programme areas of APEID such as (1) educational technology, (2) vocational and technical education, (3) curriculum development, (4) science education and (5) special education in the form of organizing seminars, workshops and providing financial contribution for the implementation of mobil training teams.

By the way, the Third Asian Seminar on Educational Technology is organized for th purpose of exchanging information on the development of computer education and computer use in education as well as preparing the regional report on this theme, requested by ACEID, which will be submitted to the international Symposium in Spring, 1985. The theme is considered by almost all the Asian Countries as one of important elements for

educational innovation the changing technological condition. It is my great pleasure to have the Seminar focused on this important issue in Japan. I would like to mention that the Tokyo Gakygei University which kindly actually hosted this Seminar enjoys high appreciation as one of the best institutions to conduct the instruction and research in this particular field in Japan.

I hope that all participants will obtain some invaluable experience and information, through exchange of views and ideas and the cooperative relationship among the countries will be further strengthened through this Seminar.

In concluding my address, I wish to express my sincere thanks and gratitude to Dr. Abe, the President of the Tokyo Gakugei University, his colleagues as well as Professor Nishinosono, who is the chairman of Japan Council of Educational Technology Centres, who have made great efforts in organizing this Seminar.

I shall conclude my brief statement by hoping that you will enjoy beautiful scenery of Japanese autumn as well.

Thank you.

Welcome Address by Prof. Haruo Nishinosono

Chairman,
Japan Council of
Educational Technology Centres.

Mr. Nishizaki, Deputy Director-General of Science and International Affairs Bureau,
Professor Abe, President of Tokyo Gakugei University,
Mr. Washio, Secretary General of Tokyo Gakugei University,
Mr. Cahill, Representative of Unesco Bangkok Office,
Distinguished participants from Asian and the Pacific Countries,
Ladies and Gentlemen,

On behalf of the Japan Council of Educational Technology Centres and on my own personal behalf, I feel very pleased in extending to you a warm welcome to the Third Seminar of Educational Technology convened as a part of the Third Cycle of APEID. I would like to express our delight to Mr. Nishizaki, and Professor Abe for your presence with us in this inauguration session. I should like to take this opportunity also to express our profound gratitude to all the persons concerned in the Japanese Ministry of Education, Science and Culture, and ACEID of Unesco. I am also very grateful to the staff of Tokyo Gakugei University for their support and encouragement given to us.

Educational Technology is widely accepted to be an infrastructural agent for promoting other activities of APEID; such as the universalization of primary education, education for the promotion of scientific and technological competence and creativity, education and work, education and rural development, professional support services and training of educational personnel, co-operative studies, reflection on and research related to future development and so on.

The Japan Council of Educational Technology have taken the responsibilities of organizing the seminars on educational technology since 1973. In the past seminars, a variety of technological problems were dealt with as the themes of training courses, workshops and seminars. We are very satisfied with the past contribution to co-operative programme of providing the opportunities of sharing experiences among the experts in the region and visiting the prominent institutions advanced in educational technology in Japan.

Since last year, we have realized that micro-computers are penetrating into educational institutions in both developed and developing countries. In some countries where you have the long history of trying out the computer use in education, micro-computers are realistic tools to actualize these trials in local schools. In other countries where the conventional computers requiring air-conditioning are not widely installed, micro-computers are promising equipment

which are getting cheaper and cheaper every time of the appearance of new models into the market. It is the right time for us to share our experiences and exchange information regarding the proper use of this new technology to solve our real problems. This year, ACEID proposed us to convene an expert meeting on computer use in education in Japan. We delightedly accepted this proposal and joined it to our annual seminar on educational technology. We are very grateful to the financial and informative support of ACEID, especially to Dr. Latif, chief of ACEID, and Mr. Cahill who has kindly taken the trouble to prepare the information package to be utilized in our discussion and attend this seminar.

I am entirely convinced that the foresight on the rational use of micro-computer will emerge from our discussion in this seminar. At the end of my talk, I sincerely hope that all distinguished participants from abroad enjoy a comfortable stay in our country and become acknowledged with each other in the seminar.

Thank you very much.

Welcome address by Dr. Takeshi Abe

As President of Tokyo Gakugei University, it is with my greatest pleasure that I extend our warmest welcome to all the participants of the Third Asian Seminar on Educational Technology in Tokyo. I would like to congratulate the participants, especially those who have come from abroad, on their distinguished achievement.

Needless to say, for a peaceful and prosperous word, education must be developed and improved. To attain that goal, it is necessary to provide appropriate personnel training and further research on the content and methodology of education. In this respect, this seminar is extremely significant, in that the distinguished people from the participanting countries have gathered here to discuss and investigate those current issues of education.

The main themes for this seminar include the utilization of computers in education, the exchanges of information and experiences as well as the investigation of case studies concerning the development of computer education, the analysis of the problems. To my great pleasure, I understand that the results of the seminar will be reported at the Unesco's International Symposium in the spring of 1985. It is sincerely hoped that the participants will have a good amount of discussion on the main themes, and that the seminar will be a great success.

Your schedule for the week to come seems to be very tight. I hope you will take care and go back home safely with an armful of fruit of the seminar.

It is also hoped that the seminar will help you deepen mutual understanding and friendship, and establish a friendly and cooperative relation among the participanting countries.

APPENDIX 2.

SCHEDULE AND AGENDA

Accommodation in Tokyo: Hotel Sun Route Tokyo
3-1, Yoyogi 2-chome, Shibuya-ku,
Tokyo
Telephone: Tokyo (03) 375-3211

Tuesday 25 Sept.

Morning	Arrive at the New Tokyo International Airport and Hotel Sun Rout Tokyo
19:00-20:30	Registration of Participants and Briefing on the Seminar by the Secretariat in the Hotel

Wednesday 26 Sept.

8:40	Leave for Tokyo Gakugei University
10:00-10:45	Opening Ceremony of the Seminar
10:45-11:00	Tea Break
11:00-11:40	Election of Officials and Adoption of the Agenda
11:40-13:00	Lunch
13:00-14:00	* Plenary Session (I) Introductory Talk by Unesco-ROEAP
14:00-15:00	Country Reports from each Participanting Country
15:00-15:30	Coffee Break
15:30-16:40	Country Reports (Cont'd)
16:40	Leave for the hotel

Thursday 27 Sept.

8:30	Leave for Tokyo Gakugei University
9:30-12:00	* Plenary Session (II) Country Report (cont'd)
12:00-13:30	Lunch
13:30-14:00	* Steering Committee
14:00-15:05	Discussion and Synthesis of Country Report

15:05-15:25	Tea Break
15:25-16:30	* Group Session (I)
16:30	Leave for the Hotel

Friday 28 Sept.

8:30	Leave for Tokyo Gakugei University
9:25-12:00	Country Report (cont'd)
12:00-13:00	Lunch
13:00-17:00	Study Visit to " Data Show " Harumi, Tokyo.
17:00	Leave for the Hotel

Saturday 29 Sept.

9:00	Leave for Tokyo Gakugei University
10:00-12:00	* Study visit to the attached Ohizumi elementary school of Tokyo Gakugei University
12:00-13:30	Lunch
13:30	Leave for the Hotel

Sunday 30 Sept.

Morning and Afternoon	> Free

Monday 1 Oct.

8:30	Leave for Tokyo Gakugei University
9:30-12:00	* Group Session (IV)
12:00-13:30	Lunch
13:30-16:30	* Group Session (V) Preparation for the Final Draft Report and Demonstration of Microcomputer Courseware for Education
16:30	Leave for the Hotel
18:30-20:30	Reception by Prof. Haruo Nishinosono, Chairman of the Japan Council of Educational Technology Centres, at Room 'Kikyo', the Hotel Sun Route Tokyo

Tuesday 2 Oct.

8:30	Leave for Tokyo Gakugei University
9:30-11:45	* Plenary Session (III) Summary Discussions for the Final Draft Report
11:45-12:00	Closing Ceremony of the Seminar
12:00-13:30	Lunch
13:30	Leave for the Hotel

APPENDIX 3.

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APPENDIX 4.

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APPENDIX 5

Standard Curriculum Guide for the Training of the Educational Usage of Microcomputer (Intermediate Report)

Contents

1 Genenal Principles

2 The Objectives Of Training

3 Training Time

4 Training Items

Ministry of Education,
Science and Culture
Tokyo, Japan

1. General Principles

(1) This 'Standard Curriculum Guide (CG) for the study of the educational usage of micro-computer' aims at providing materials for substantial training carried out by educational institutes for all those involved in education. It explains the aim and program of the training of the educational usage of micro-computer and also it serves as standard reference for the different levels of the training.

(2) This Curriculum Guide mainly seeks to help in the training of the general operation and methods of usage of the micro-computer for the various educational activities. Therefore it is hoped that those who have completed this training will go further for training closely associated with various non-formal educational activities and various subjects in formal education. Moreover this CG has no direct concern for the training of specialized field of computer study in the various formal subjects.

(3) It is hoped that this CG can be creatively used to help in substantial training of the educational usage of micro-computer in educational administrative institutes, formal educational institutes (AV centre, educational centre, schools etc.); non-formal educational institutes, AV educational and other educational research groups at different levels all over the country.

(4) This CG divides the training of the educational usage of micro-computer into 3 levels - elementary, intermediate and advance. It also sets the standard for the training objectives, training hours and essential training content for the 3 respective levels. This training is for teachers, office staff and supervisors of non-formal educational institutes, non-formal educational supervisors, private voluntary instructors, etc., and according to their levels of familiarity with the microcomputer, the trainees are placed in different levels.

(5) The 'Elementary Level' is for people involved in education who have no experience with the use of computers and it is designed for the acquisition of minimum essential knowledge of skill in the educational usage of micro-computers. When they have completed this level of training, the participants' interest in and concern for the use of micro-computer will be heightened, and their ability to use the available programmes and write simple programmes will be cultivated. It is hoped that as many as possible of those who are involved in education may be equipped with ability at this level.

(6) The 'Intermediate Level', designed for people involved in education who have acquired knowledge and skill at the elementary level, provides them with further necessary knowledge and skill for the effective usage of micro-computer in the implementation of educational activities. Upon completing such training the participants will have higher ability in ually writing programmes themselves, and the ability to evaluate various software, to apply them effectively to educational situations. It it hoped that as many as possible of those who have completed the elementary level, or those who have mastered equivalent level of knowledge and skill may be equipped with ability at this level.

(7) The 'Advance Level', designed for those involved in education who have acquired knowledge and skill at intermediate level, provides them the necessary knowledge and skill to instruct the advance and comprehensive use of micro-computer in education. Upon completing such training the participants will have the ability to build a system and instruct the use of micro-computer in education. It is hoped that those who are instructors in the educational usage of micro-computer in different regions may be equipped with ability at this level.

(8) In making plans for a training programme using the CG as a reference, the following consideration is important. Make appropriate selection of the training items as shown in the CG, and according to need and new training times to the programme. In the various levels of the training it is necessary to deal appropriately with the general themes of the relationship and educational meaning of computer and new medium.

(9) Regarding the distribution of time,as shown in the CG, roughly it is thought in terms of 6 hours per day, with 2.5 days for elementary level; 5 days for intermediate level; and 8 days for advance level. Also according to the training items it may be more appropriate to have formal education and non-formal education carried out separately or sometimes it may be more appropriate to have them combined. In any of the above mentioned case , such instructions will be given in the CG regarding time and the training items. It is hoped that formal educators and non-formal educators will follow the respective number of hours of training as indicated for the items 'Formal' and 'Common' or 'Nonformal' and 'Common'.

(10) The training time and items of the CG is divided into the following main categories: generel statement, operation, programming and application. These are supposed to follow the general trend of the training. In other words starting with the general statement, we go on to the operation, the

programming and the application. In planning the training, developing appropriate training methods, teaching materials for the above respective areas is expected.

(11) In the CG, basic programme language is supported to be used in the area of programming, but according to need it is hoped that other language may be introduced. Also, since the development of the software and hardware of micro-computer is in progress, it is important to respond with flexibility to changes to make plans for the training.

2. The Objectives of Training

(1) Elementary Level

1. Objectives regarding knowledge
   a. to acquire basic knowledge about micro-computer hardware and software.
   b. to acquire basic knowledge about the possibilities of the educational usage of micro-computer.
   c. to acquire basic knowledge about programme.
   d. to acquire general knowledge about the role of computers in society.

2. Objectives regarding skill
   a. to be familiar with the operation the keyboard, and using the memory unit for the output /input of programme.
   b. usage of available basic programme.
   c. to write elementary programme.

(2) Intermediate Level

1. Objectives regarding knowledge
   a. to acquire knowledge for placing micro-computer in the practical scenes of education.
   b. to increase practical knowledge about the structure of programming language and data.
   c. to evaluate and know widely examples of the application of micro-computer to education.
   d. to understand about educational subjects which come with the spread of computer.

2. Objectives regarding skill
   a. to be skillful in the operation of the keyboard and peripheral input/output unit.
   b. to analyze subject to write practical programme which can be applied to specific educational scenes.
   c. to understand and evaluate available software, or to learn the skill to repair and to use them effectively.

(3) Advance Level

1. Objectives regarding knowledge
   a. to acquire knowledge for the application of computer systematically and structurally to practical scenes in education.
   b. to acquire knowledge for the instruction of micro-computer for educational usage.
   c. to acquire comprehensive knowledge about the present condition and the meaning of information media.

2. Objectives regarding skill
   a. to learn the skill regarding the analysis of problems, the designing of systems and the policies of operation etc. for the systematic and structual application of using micro-computer in education.
   b. to learn instructional methods for teaching the educational usage of micro-computer.

3. Training Time

(1) Training Time

(hours)

Level	Elementary			Intermediate			Advance		
	Com.	For.	Non.	Com.	For.	Non.	Com.	For.	Non.
General	3			2	1	1	3	3	3
Operation	3			3			6		
Programming	6			6	6	6	9	9	9
Application	2	1	1	6	6	6	9	9	9
Total	14	1 (15)	1 (15)	17	13 (30)	13 (30)	27	21 (48)	21 (48)

(remark) Assuming 6 hours of training for one day, there should be 2.5 days for Elementary Level; 5 days for Intermediate Level and 8 days for Advance Level. Figures put in ( ) are the hours added to the combined time.

(2) Training area and training method

1. General Statement
   In the training courses for the three respective levels it will mainly be through lectures that a general outline of study would be given for the introduction of content, the micro-computer itself and its educational usage at different levels.

2. Operation
   to do practical work at different levels to get familiaried with the operation of keyboard and peripheral unit of hardware.

3. Programming
   to practice the designing of system and writing programme at different levels; to emphasize the analysis of subject as a preface to programming.

4. Application
   to learn necessary knowledge and skill about the application of micro-computer for educational usage at different levels. Lectures, practical work and discussion will be used.

4. Training Items

(1) Elementary Level

1. General Statement (common 3 hours)
   - The roles of computer in society.
   - Hardware and software of micro-computer.
   - Programming and data.
   - The fields of usage in education.

2. Operation (common 3 hours)
   - Operation of unit and keyboard.
   - The operation of acessary memory unit.

3. Programming (common 6 hours)
   - Analysis of flowchart and subject.
   - Usage and function of available programme.
   - The fundametal of BASIC and writing programme.
   - The filing of programme for acessary memory unit.

4. Application (common 2 hours. 1 hour respectively for formal education and non-formal education)
   - (common) The possibilities of using micro-computer.
   - (formal) Using micro-computer in formal edocation.
   - (non-formal) Using micro-computer in non-formal education.

(2) Intermediate Level

1. General Statement (common 2 hours. formal education and non-formal education 1 hour respectively)
   - (common) The application of micro-computer to practical scene in education.
   - (common) The variety of software and programming language.
   - (formal) Using micro-computer in formal education
   - (non-formal) Using micro-computer in non-formal education.

2. Operation (common 3 hours)
   - Operation of keyborrd.
   - Using the peripheral input/output unit.

3. Programming (common 6 hours. formal and non-formal education 1 hour respectively)
   - (common) The method of analysing subject and the skill of basic programming.
   - (common) Trying to use other than BASIC programming language.
   - (common) To make programme of fixed subject.
   - (formal) To make programme of free subject (specific area)
   - (non-formal) To make programme of free subject

4. Application (common 6 hours, school. non-formal education 1 hour respectively)
   - (common) Evaluating and managing software.
   - (common) The variety of education study information and structure of data.
   - (common) The content and method of computer literacy education.
   - (formal) The usage of micro-computer in teaching
   - (formal) Data-processing in school.
   - (formal) Case study.
   - (non-formal) The usage of micro-computer in non-formal educational activities.
   - (non-formal) Dealing with information in non-formal educational institutes.
   - Case study.

(3) Advance Level

1. General Statement (common 3 hours, formal and non-formal education 3 hours each)
   - (common) The theory and practice of computer in education.
   - (common) The skill and process of building computer system.

2. Operation (common 6 hours)
   - Usage of hardware for the building of system.

3. Programming (common 9 hours, formal, non-formal education 9 hours each)
   - (common) Case study of system building.
   - (formal) Designing specific system for the usage of computer in school.
   - (non-formal) Designing specific system for the usage of computer in non-formal education.

4. Aplication (common 9 hours. formal . non-formal education 9 hours each)
   - (common) The subject and social, educational meaning of information communication media.
   - (common) The evaluation. management and operative skill of system.
   - (common) Methods of instruction of the educational usage of micro-computer.
   - (formal) Designing lessons and micro-computer.
   - (formal) The building of database and the systematization of educational information processing.
   - (formal) Making plans for the instruction of the educational usage of micro-computer.

- (non-formal) The development of non-formal educational activity and micro-computer.

- (non-formal) The building of database and the systematization of educational informaion processing.
- (non-formal) The making of plans for the instrucion of the use of micro-computer for educational usage.